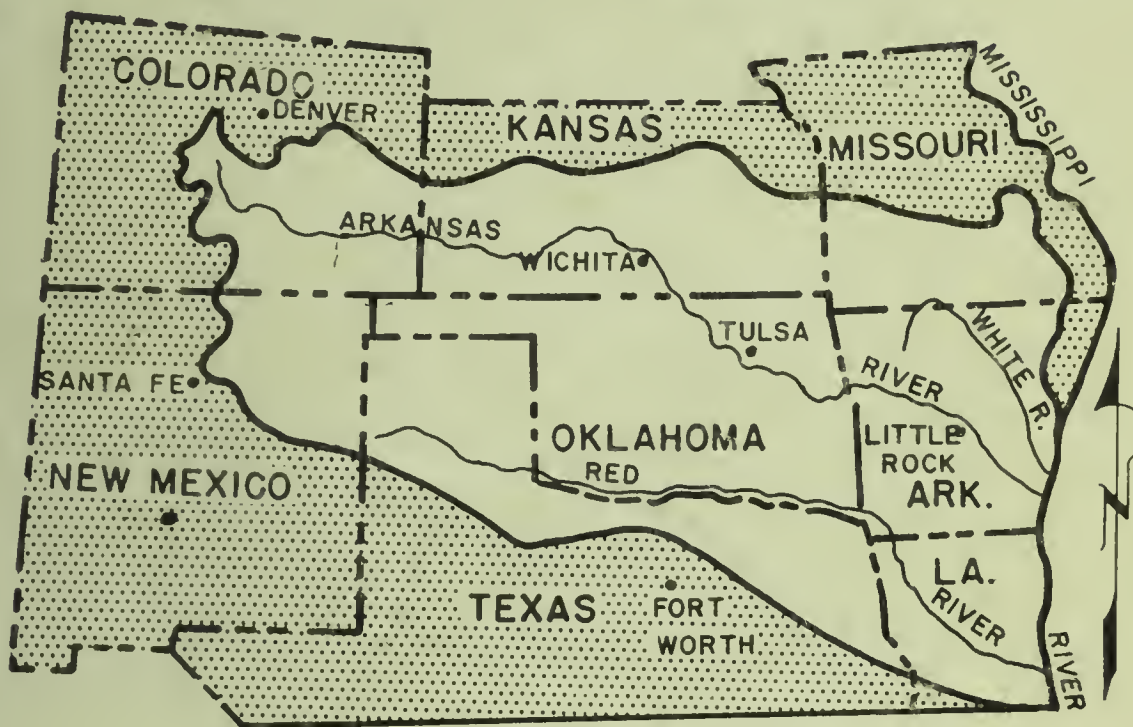


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Public Domain Lands

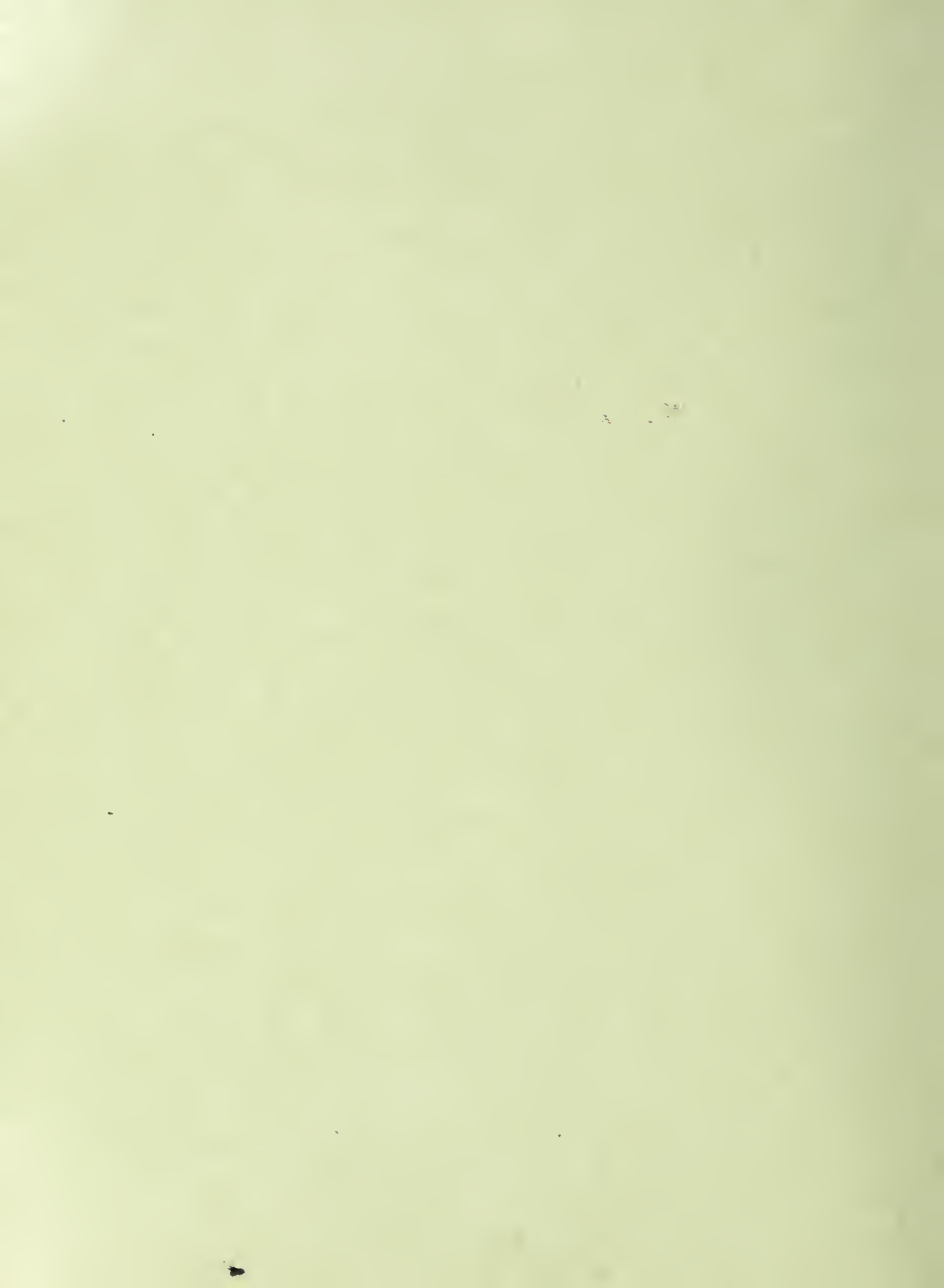
ARKANSAS - WHITE - RED RIVER BASINS



ARKANSAS - COLORADO - KANSAS
LOUISIANA - MISSOURI - NEW MEXICO
OKLAHOMA AND TEXAS

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UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT



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ARKANSAS-WHITE-RED RIVER BASINS

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DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

Denver, Colorado

June 1961

Public domain lands considered in this report are located in the Arkansas and Red River Basins within Colorado, Kansas, New Mexico and Oklahoma. The area inventoried for this report is located in the upper Arkansas River Basin in the Rocky Mountains of central Colorado.



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PREFACE

In 1955 the Arkansas-White-Red River Basins Inter-Agency Committee concluded its study of the natural resources and needed developments in the broad Arkansas-White-Red River Basins, with a series of detailed reports dealing with the natural resources of this range area. The Bureau of Land Management had as a contribution to this study completed a detailed inventory of resources on the public lands remaining in the Basins and released a Preliminary report of the Bureau of Land Management Program in the Arkansas, White and Red River Basins, 1952.

The combined basins cover more than 180,000,000 acres in Arkansas, Colorado, Kansas, Louisiana, Missouri, New Mexico, Oklahoma and Texas. At one time all except a small proportion of the total area was public land. During the century and a half since the Louisiana Purchase the title to nearly all of the public domain in the area passed from the Federal Government to private individuals or to States.

When the Arkansas-White-Red study was made only about a million acres of this land remained in Federal ownership. These remnants of a land disposal program were concentrated in the less productive lands in the upper Arkansas-White-Red drainage. The productive capacity of the lands compared with the fertile valleys downstream is relatively low. Soils are derived from granite and related rocks and are highly eroded. This area is characterized by a delicate balance among soil conditions, natural vegetal cover and climate. These lands, now under the administration of the Bureau of Land Management, are used primarily for grazing, and require careful management to achieve maximum productivity and to prevent serious losses from floods and damage from deposition of sediment in the developed areas downstream.

This report summarizes for use information on location and characteristics of the public domain lands and recommends management and treatment. The basic information was obtained during the course of a land inventory and classification study carried on in connection with the original Arkansas-White-Red Basin study. It includes a brief discussion of the basin region covered by the Arkansas-White-Red River Basin report, and a more detailed discussion of the resources on the remaining public lands.

The field study was under the direction of William N. Anderson, Regional Chief, Division of Land Planning, Region 4, and Harold T. Tysk, Regional Chief, Division of Land Planning, Region 5, Bureau of Land Management. The manuscript, as prepared for the Basin report, has been condensed and brought up to date by the combined efforts of Charles Peteler, Missouri Basin Studies Unit; Lowell Puckett, State Director for Colorado and his staff; and Rowland G. Thompson, Manager of the Canon City District; all of the Bureau of Land Management.

The report is divided into two parts:

1. The general discussion of natural factors and resource development in the Arkansas-White-Red Basin.
2. Discussion of the areas in which the remaining public land is located, and a discussion of problems associated with the management of these public lands.

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AREA 1 MAPS, UPPER ARKANSAS RIVER BASIN, COLORADO

Twelve maps in the pocket on the back cover.

Colorado Grazing District 5 Maps

Erosion
Land Status
Land Use Capabilities
Vegetative Type

Huerfano Area Maps

Erosion
Land Status
Land Use Capability
Vegetation Type

Leadville Area Maps

Erosion
Land Status
Land Use Capabilities
Vegetative Type

GENERAL DESCRIPTION

Location and Size

The Arkansas, White, and Red River Basins are located in eight states; Colorado, Kansas, Oklahoma, Texas, New Mexico, Missouri, Arkansas, and Louisiana. These three basins include approximately 280,000 square miles or about one-tenth of the land of the United States. The location and general outline of these basins are shown on figures 1, 2, 3, 4 and 6. Arkansas River Basin, largest drainage area of the three, is situated in the northern part of the area. Source of the Arkansas River is on the Continental Divide, high in the Rocky Mountains near Leadville, Colorado. The river flows through Kansas, Oklahoma and Arkansas before reaching the Mississippi River near Arkansas City, Arkansas. Parts of the Arkansas River drainage are in the Panhandle of Texas and southwestern Missouri. For the first 100 miles of its course the river is a typical mountain stream flowing through deep canyons flanked by snowy mountains, in the Colorado Rockies to Canon City. Eastward to the Mississippi the river meanders across broad gently sloping plains. The drainage basin of this river includes some 160,000 square miles or 57 percent of the Arkansas, White and Red River Basins.

The White River Basin is located in southern Missouri and northern Arkansas. The river rises in the Boston Mountains near Fayetteville, Arkansas, takes a northerly course into Missouri, where after flowing a few miles eastward through southern Missouri, it turns southeast into Arkansas and then flows southward paralleling the Mississippi River for approximately 100 miles before entering it a few miles above the mouth of the Arkansas River. The drainage area is about 28,000 square miles, or 10 percent of the total area. In the upper reaches of the White River the drainage is characterized by narrow valleys and steep slopes, while in the lower reaches the river meanders through flat alluvial valleys. This Basin is not considered in this report as the active program of the Bureau of Land Management there has been completed.

The Red River has its origin in the plains country of northeastern New Mexico and northwestern Texas, crosses the Texas Panhandle, flows along the boundary between Oklahoma and Texas, thence through the southwestern corner of Arkansas and southeasterly through northwestern Louisiana to the Mississippi River. Low and unstable banks are characteristic of this stream. The channel is shifting and meandering in the upper reaches. Red River drains an area of some 92,000 square miles or about 33 percent of the three basin area.

Physiography

Regional elevations are shown in figure 1 on an outline of the Arkansas, White and Red River Basins. The rugged and precipitous Rocky Mountains are on the west with elevations above 14,000 feet. Eastward 50 to 100 miles, the elevation drops to approximately 5,000 feet. Bordering this rugged mountainous terrain in the western part are tablelands that have been dissected by streams which have formed narrow valleys. This feature gradually changes into the flat and undulating plains which give way to the rough valley lands cut by the meandering streams as the elevation approaches sea level. The major portion of the public domain is located in the more rugged western part of the basin, usually above 5,000 feet elevation.

Soils

Seven broad environmental soils groups of the Arkansas, White and Red River Basins are graphically depicted in figure 2. The differentiation between groups is on the basis of characteristics common to the soils of a large area of the country, and therefore localized variations are not shown. The generalized location of each soil group, its characteristics, the climate, topography, native vegetation, principal soil uses, and the significance of public domain within each is presented in table 1. Dominant soil groups in the mountains, where over half of the public domain of the basins is located, are the brown; the red and yellow podzolic; and the mountain areas soil groups.

Precipitation and Vegetation

Annual precipitation in the Arkansas, White and Red River Basins ranges from less than 15 to more than 60 inches. The isohyetal map, figure 3, indicates a rainfall pattern increasing from west to east. With the exception of a narrow subhumid belt in the high Rocky Mountain areas along the western edge, approximately the western one-third of the basin is in a rainfall belt of less than 20 inches. Most of the public domain land is located in this arid region. The central one-third of the basins is in a precipitation belt ranging from 20 to 40 inches, while the eastern third is in the rain belt receiving from 40 to 60 inches.

Annual precipitation is the most significant factor in determining the type of natural vegetation, so there is a close correlation between the pattern of precipitation and the vegetal cover. Desert shrub and short grass vegetation coincide with the low rainfall area; the prairie grassland country is in the intermediate rainfall belt, and the forest country is located in the high rainfall belt.



FIG. 1

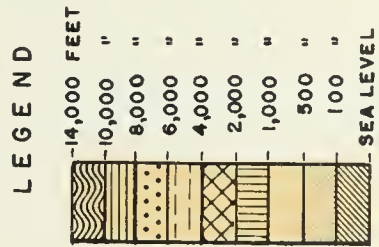


FIG. 2



ARKANSAS-WHITE-RED BASINS
GREAT SOILS GROUPS
BUREAU OF LAND MANAGEMENT

Table 1.--General characteristics of the broad soil groups within the Arkansas-White-Red River Basins as shown in Figure 2, and the significance of public domain within each soil group

Soil Group	Characteristics and parent material	Topography	Climate	Location in AWR Basins	Native vegetation	Productivity (crop plants)	Present Use	Significance of public domain
Mountain areas	Vary from rock outcrops to alluvial deposits in valleys. Derived from rocks of pre-Cambrian Age, principally granite, schist and gneiss.	Mountainous, steep slopes and narrow valleys.	Cool, subhumid precipitation 15-30 inches.	South-central Colorado headwaters of Arkansas River.	Mountain browse, mixed conifer, pinon and juniper, short grasses, mid-grasses and forbs.	Low productivity. Must be carefully managed to prevent accelerated erosion.	Recreation; grazing; live-stock and big game.	558,000 acres public domain located at higher elevations in mountainous sections of the Arkansas Basin in Colorado.
Brown	Brown soil grading into whitish calcareous horizon at 1 to 3 feet. Parent material yellowish-brown calcareous clay.	Undulating to nearly flat in plains country and smooth to rolling with places severely dissected and eroded near mountains to the west. Elevations 3000 to 7000 feet.	Temperate to cool, arid to semi-arid; annual precipitation 15-20 inches. High winds.	High plains southwest-ern Kansas, southeast-ern Colorado, west tip Oklahoma Panhandle, northwestern corner Texas Panhandle.	Short grass and bunch grass prairie	High, if irrigated.	Countries range from 25 to 50 per cent cultivated land; grain sorghums, sorgo and corn under dryfarming methods. Alfalfa, sugar beets; corn under irrigated methods. Much of the land is grazed.	198,000 acres of the total public domain in the Arkansas Basin are located in south-eastern Colorado and north-eastern New Mexico.
Northern Prairies	Dark brown or grayish-brown grading to lighter colored parent material at 2 to 5 feet. Parent materials - cherty limestones and shales.	Rugged and stony hills.	Temperate to cool; temperate, humid. Annual precipitation 30-45 inches.	Southeastern Kansas and northeastern Oklahoma.	Bluestem grass.	High.	Medium to small farm units. General farming. Hogs and cattle. Spotted areas suited to corn, sorghums, alfalfa, sweet clover, fruit.	None.
Southern Prairies	Dark brown or reddish-brown grading to heavier textured subsoil of parent material. Parent materials "Red Beds", clays and sandy clays mainly.	Undulating to rolling prairie country. Elevation from 500 to 1000 feet above sea level.	Warm temperate subhumid to humid. Annual precipitation 28-45 inches. Summers hot, winters mild, some tropical conditions.	South-central Kansas through Oklahoma into north-central Texas.	Tall and mixed grass prairie. Some grama grass.	Medium to high.	Crops and pasture wheat, oats, corn, cotton, hay and forage.	Scattered small tracts of public domain--16,000 acres.
Northern Chernozem	Black or dark grayish-brown friable soil, 3 to 4 feet grading to lighter color with lime accumulation. Parent materials, shales and limestones.	Smooth, flat to undulating plains. Elevation 1500 to 2200 feet.	Temperate to cool subhumid. Annual precipitation 18-30 inches.	Central Kansas.	Tall grasses, bluestem and bunch.	Medium to high.	General farming: alfalfa, corn, grains.	Very little public domain--500 acres.
Southern Chernozem (Red Chestnut soils)	Dark brown friable and platy soil. Lime accumulation $1\frac{1}{2}$ to $4\frac{1}{2}$ feet. Parent materials "Red Beds", clays and shales, and sandy clays. Also reddish-brown sandy soils.	High plains, flat country and undulating and rolling plains. Elevations 2000 to 5000 feet.	Warm temperate to hot. Semi-arid. Annual rainfall 15-30 inches.	Rolling plains northern and northwestern Texas, western Oklahoma, southern Kansas, north-eastern New Mexico.	Mixed grasses--shrubs bluestem, grama skinoak. Trees on shallow sandy soil.	Medium. High when irrigated.	Cotton, wheat, sorghums, other feed crops, pasture waste.	Spotted, scattered tracts of public domain concentrated along river bottom in Oklahoma --about 15,000 acres.
Red and Yellow Podzolic	Thin dark-colored organic covering over pale yellowish-gray leached layer. B horizon heavier textured and ranging in color from yellow to mottled red and gray. Parent materials cherty limestone and shales.	Gently to sharply rolling with large areas of rough valley land with intervening, relatively smooth divides. Elevations 900 to 1300 feet above sea level.	Warm temperate to subtropical and humid. Annual precipitation 35-60 inches.	Southern Missouri, Arkansas, southeastern Oklahoma, northern Louisiana.	Mixed coniferous and deciduous forest. Oak, hickory, maple, elm, walnut, blackjack and short leaf pine. Tall, coarse grasses.	Low to medium, responsive to good management and fertilization.	Small to medium sized farm units. About half cultivated. Rough portion timbered and used for woods pasture, crops--corn, wheat, oats. Livestock production important. Also orchard crops.	Approximately 6,000 acres; scattered tracts of public domain.

Comparison of figures 3 and 4 will show the close correlation between precipitation and the type of vegetation. Wide variations in temperature, precipitation, snowfall and other climatic features occur within short distances. These variations are associated with sharp elevation differences and exposures. Greatest extremes occur in the mountain areas of the west. Narrow mountain valleys may have much less snowfall and warmer winter temperatures than the adjacent mountains.

Minerals--Nonrenewable Land Resources

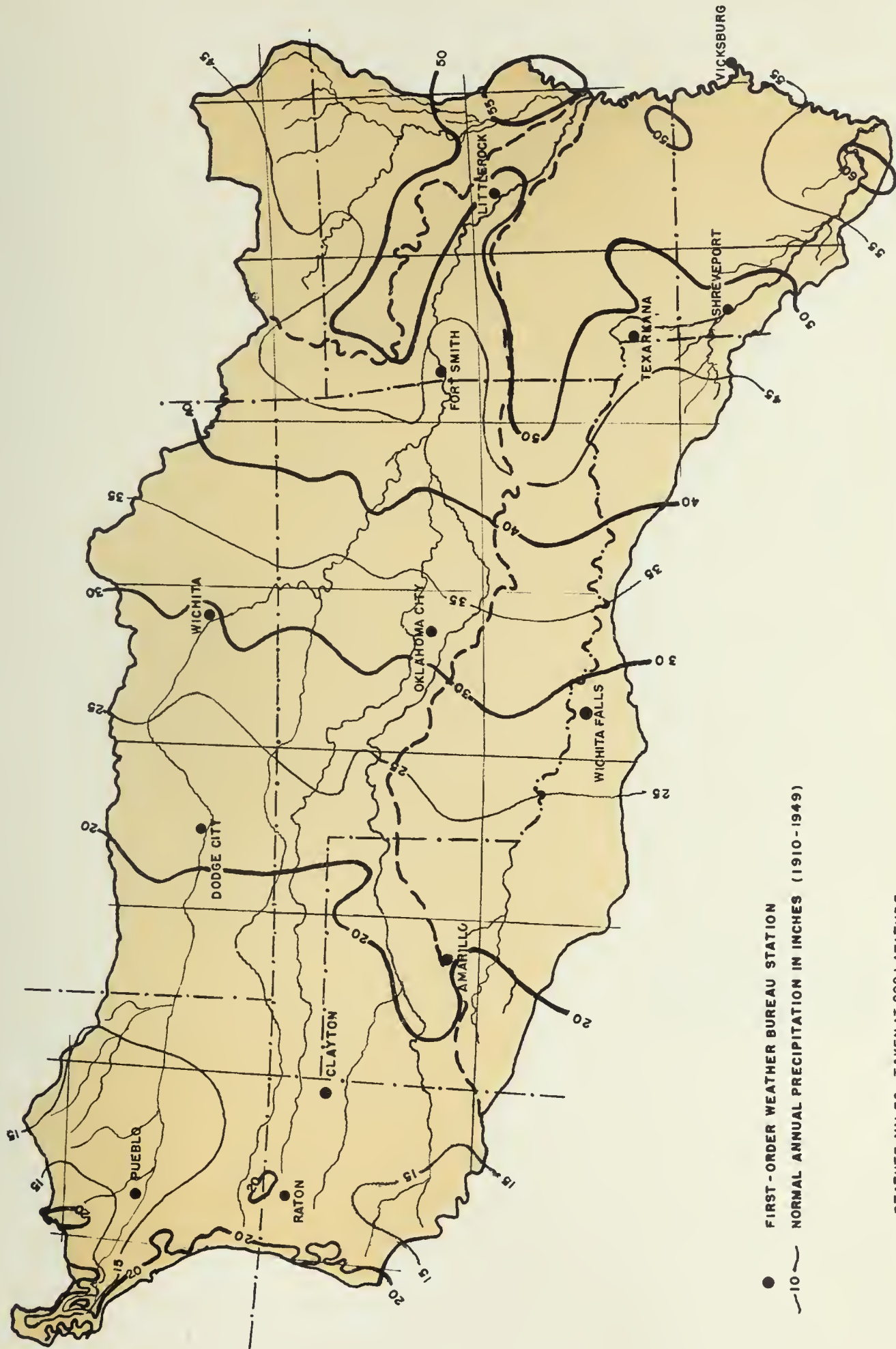
There is little public domain land remaining in the basins of the Arkansas and Red Rivers except in the extreme northwest corner in the upper reaches of the Arkansas River and its tributaries in Colorado. Little public domain land remains in New Mexico, Kansas and Oklahoma. The largest blocks of public domain and those having the greatest mineral potential are in Colorado.

Mineral production on public domain lands in the Arkansas and Red River Basins falls into three broad administrative classifications:

1. Leasable minerals, including coal, oil, gas, potassium, sodium, phosphate, and oil shale, and sulphur in the States of New Mexico and Louisiana. Act of February 25, 1920 (41 Stat. 437), as amended.
2. The locatable minerals or minerals which can be claimed, produced and marketed by the discovery and location of a valid mining claim. Act of May 10, 1872 (17 Stat. 91), as amended.
3. Mineral materials which may be obtained by purchase, either by negotiated sale or by competitive bid as provided by the Act of July 31, 1947 (61 Stat. 681), as amended.

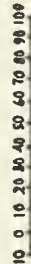
Mineral production in the area has varied in volume and type with a rich history, an active present and a promising future. Storied camps and mining towns dot the area. Leadville of the gold-silver days, rich in production with a lore extending to modern Grand Opera; Cripple Creek, one of America's more recent roaring gold regions that produced many millions in the years 1890-1920. The Golden Cycle still operates a mine and mill at Victor in the Cripple Creek district, producing a million dollars worth of gold annually.

FIG. 3



● FIRST-ORDER WEATHER BUREAU STATION
 —10— NORMAL ANNUAL PRECIPITATION IN INCHES (1910-1949)

STATUTE MILES—TAKEN AT 80° LATITUDE



ARKANSAS-WHITE-RED BASINS
 NORMAL ANNUAL ISOHYETAL MAP

FIG. 4



Less glamorous minerals, but more steady and durable in their operation are coal, centering at Trinidad, and the lead zinc mines of the Tri-state District of Kansas, Missouri and Oklahoma near Columbus, Joplin and Miami.

The world's largest molybdenum mine, now being expanded, is at the headwaters of the Arkansas River at Climax, over 11,000 feet high in the Colorado Rocky Mountains.

Metallic and nonmetallic mineral production in the Arkansas and Red River Basins for 1959 is shown in the following tabulation:

Mineral	Unit	Number of units produced, by states			
		Colorado	Kansas	New Mexico	Oklahoma
Gold	troy oz.	32,302			
Silver	troy oz.	13,293			
Copper	ton (2,000 lbs.)	14			
Lead	ton (2,000 lbs.)	122	481		601
Zinc	ton (2,000 lbs.)	7	1,017		1,049
Uranium (U ₃ O ₈)	lbs.	1/ 82,575			
Tungsten concentrates	ton (2,000 lbs.)	I/ 1,000			
Tin concentrates	ton (2,000 lbs.)	56			
Molybdenum (MoS ₂)	ton (2,000 lbs.)	1/ 19,650			
Pyrite	ton (2,000 lbs.)	I/ 83,700			
Peat	ton (2,000 lbs.)	1/ 2,200			
Petroleum	M barrels	43	2/	2/	196,487
Natural Gas	million cu.ft.	2/	1/529,610		811,508
Natural Gas Liquids	M gal.		232,688		1,124,222
Carbon Dioxide Gas	M cu.ft.	1/ 87,600			
Carbon Dioxide Gas	Tons dry ice			9,500	
Helium	M cu.ft.		21,643		98,749
Coal	M tons	1,038	770	82	1,525
Sand and Gravel	M tons	4,515	5,440	2,087	6,002
Stone	M tons	1,371	2/	4	12,683
Clays	ton (2,000 lbs.)	102,442	2/		966,000
Cement	M barrels	2/	2/		2/
Lime	ton (2,000 lbs.)	2/	1/ 9,050		2/
Gypsum	ton (2,000 lbs.)		2/		2/
Salt	ton (2,000 lbs.)		1/ 950,000		

M = 1,000

1/ Estimated figure

2/ Data not available

Uranium and zinc are produced by processing plants at Canon City. Cement is manufactured at Portland near Canon City and at several plants in Kansas and Oklahoma. There are several minerals in the area which may become more valuable in the future--sand, stone, gravel, pumice, pumicite, cinders, clay, and expandable shales.

During 1960, receipts received from royalties on production and rentals from leases under the Mineral Leasing Act from the public domain and certain privately owned lands in which the minerals are reserved to the Federal Government in these basins are as follows:

Colorado	\$282,235
Kansas	338,225
New Mexico	3,567
Oklahoma	52,673
Arkansas-Red River Basin Total	\$676,700

There are no mineral royalty or leasing receipts reported in 1960 for the State of Texas within the Arkansas-Red River Basin from lands administered by the Bureau of Land Management.

Farm Lands and Irrigation

In the Arkansas River Basin within Colorado there are 3,600,000 acres of cropped land; 13,100,000 acres of grazing land; and 1,800,000 acres of forest land. Dry-farmed or non-irrigated cropland covers 3,138,834 acres of the Arkansas River Basin within Colorado. Irrigated land area is 461,166 acres, much of which may have an inadequate supply of water in years of low stream flow. Irrigation is limited by available water supply rather than suitable land. Suitable additional lands under existing irrigation systems cover 70,000 acres.

Lands classified as suitable for irrigation by the Bureau of Reclamation beyond existing irrigation systems total 352,000 acres in the Arkansas River Basin within Colorado. The Colorado Coordination Committee of the AWRB inter-Agency Committee considers that an additional 1,200,000 acres are suitable for irrigation, much of it by pumping from underground aquifers. This information was published by the Committee in October, 1953, in their report entitled "A plan for the development, use, and conservation of the resources of the Arkansas Basin in Colorado."

Surface irrigation water is especially short during the late summer irrigation season months of August, September and October. This shortage has been alleviated to some extent by constructing reservoirs, by supplemental pumping and by importing Colorado River water through six transmountain diversions. John Martin Reservoir stabilizes the water supply for 120,000 acres in Colorado and Kansas.

The existing transmountain diversions, consisting of four ditches and two tunnels, divert an average of 46,140 acre feet annually to the Basin. An additional ditch diverted 1,230 feet annually prior to 1944. All these diversions are high in the Rocky Mountains near the source of the Arkansas River. All are in Lake County except one in Chaffee County near Poncha Springs.

Development of additional supplies of irrigation water are very important to the Colorado portion of the Arkansas Basin, as they are necessary not only for expansion of the irrigated area but also to improve irrigation on presently irrigated areas. Additional irrigation water supplies are needed for the proper production of high return crops.

Irrigated land produces three times the profits realized on dry-farmed lands in the area, on the average, and for high return crops, such as sugar beets, melons and onions, the returns are usually many times those realized on dry-farmed lands.

The proposed Frying Pan-Arkansas Project plans to divert Colorado River water from the Western Slope of the Rocky Mountains, transmountain through a long tunnel with compensatory storage to prevent adverse effects on Western Slope water users. Diverted and flood waters would be conserved by storage in two enlarged existing reservoirs, Sugarloaf and Twin Lakes, and in the proposed Pueblo reservoir.

Transmountain diversion, storage and regulation of existing diversions would provide sufficient water to supplement present inadequate irrigation supplies and to supplement the supply of municipal and domestic water for Pueblo, Colorado Springs, and eight Arkansas Valley towns. The project would generate electrical energy and would also provide flood protection for the reach of the Arkansas River from the new Pueblo Reservoir to the existing John Martin Reservoir. Floods in this reach of the Arkansas River have caused extensive damage and some loss of life.

The project would contribute to economic stability, growth and development of the Arkansas Basin in Colorado. This region presents attractive features of climate, scenery and resources for residential, commercial and industrial development that are unusual, but without ample water and power for municipal, industrial and irrigation supplies, the Area cannot develop its potential. Colorado Springs, Canon City and other Arkansas Valley points have been appreciated nationally for many years as highly desirable resort, residential and retirement locations.

New uses and demands as well as increased amounts of recreational use would develop for land administered by the Bureau of Land Management as a result of the construction of the Frying Pan-Arkansas Project.

AREA ECONOMY

Economy of the area is founded on its natural resources which provide a base for extractive industries, agriculture, processing plants, recreation, tourism, residence and transportation. West of Pueblo, Colorado, mining, mineral processing, ranching, recreation and tourism are the principal activities. Largest enterprise is the molybdenum mine at Climax, high in the Rocky Mountains at the source of the Arkansas River. Leadville, an historic mining center for silver, is over two miles high. Cripple Creek mining district has produced many millions in gold and it still mines and processes over \$1,000,000 in gold alone annually. Silver, gold and other metals were also mined in Custer County.

Zinc is processed in a smelter at Canon City and refractory brick are manufactured there. A large cement mill is located at Portland, near Canon City, Colorado. Mountains and valleys in this part of the area provide range and hay for a flourishing livestock industry.

Fish and big game attract thousands of sportsmen to the western part of the area. Mountain scenery, rushing rivers, lakes, streams and historic mining communities offer recreation and diversion to many more thousands of tourists. Interstate and local travel on U.S. 50 and Colorado highways produce substantial revenue for the area west of Pueblo.

Agriculture increases in intensity eastward from Pueblo, Colorado. Ranching remains important in Colorado, Kansas and Oklahoma, but native range and hay are largely replaced by grazing winter wheat and pastures, a typical use of the Kansas-Oklahoma dry-farmed area. Irrigated land in the Arkansas Valley is used for alfalfa, corn, small grain, sugar beets, sorghum, melons, truck crops, beans and pasture. Wheat is the leading non-irrigated land crop, followed by broomcorn, corn, sorghum, beans, barley and oats. Beef cattle, sheep, dairying, fattening livestock, hogs and poultry are important enterprises. In Oklahoma, cotton becomes an important crop. Minor crops in Oklahoma, in addition to those listed, are lespedeza, peanuts and sweet potatoes.

Crop and livestock processing plants are important business enterprises in the area. Grain elevators are the most numerous crop handling structures. There are four beet sugar factories in the Arkansas Valley in Colorado. Here also are two large flour mills, two breweries and several canneries. Each town has a dairy or creamery and each city has several.

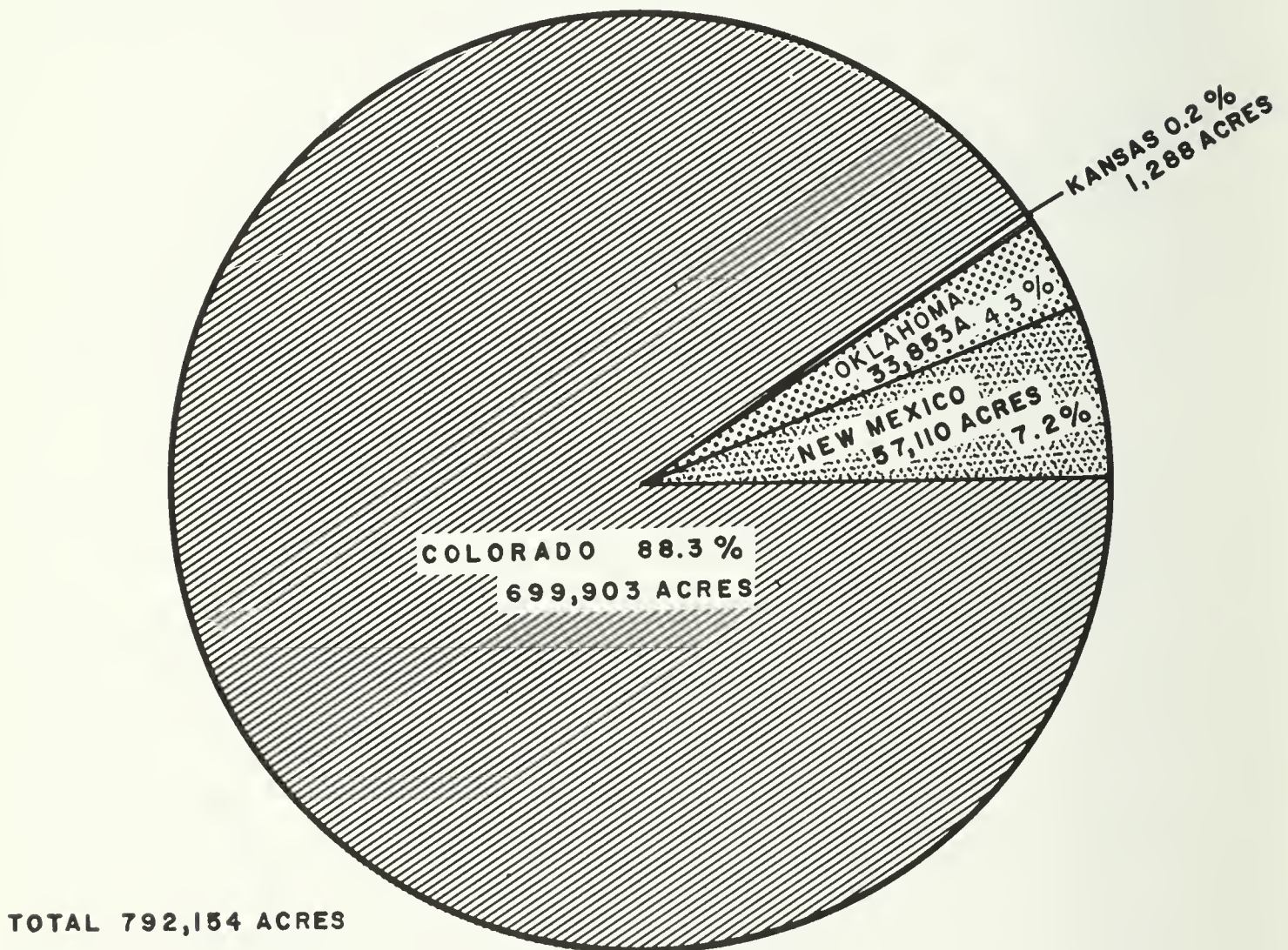
There are numerous manufacturing establishments in the Colorado portion of the Arkansas Basin. Listed in order of numbers of establishments, they include food and similar products, printing and publishing; stone, clay and glass products; lumber and products; miscellaneous manufacturing; machinery, except electrical; primary metals industry; fabricated metals products; chemicals and allied products; furniture and fixtures; apparel; petroleum and coal products; leather and products; transportation equipment; instruments and related products.

There are additional large numbers of manufacturing establishments in the Arkansas and Red River Basins within Kansas, Oklahoma and Texas. Mineral products plants are important manufactories in the Arkansas and Red River Basins in Colorado, Kansas, Oklahoma and Texas. Mineral products plants include natural gasoline plants, petroleum refineries, carbon black plants, brick and tile kilns, petrochemical plants, glass manufacturers, zinc and lead mills, cement mills, and steel and iron plants.

Colorado Fuel and Iron Corporation steel mills at Pueblo are the largest industrial plant in the Area. The mills are completely integrated and are widely diversified, producing rods, structural and angle steel, rails and track accessories, wire, nails, fence, welded fabric and other wire products. Specialties include grinding balls and earth handling machine blades. Most recent addition to the plant is the tube mill. The plant has 17 open hearths, four blast furnaces and a new oxygen converter. Capacity is 1,000,000 ingot tons per year. Coal mined in Las Animas County within the Area is processed in by-product coke ovens. Iron ore is shipped in from outside of the area from Wyoming and Utah. Founded in 1882 by William Palmer, the railroad builder, to produce rails and track accessories for the rapidly expanding railroads and mines of that day, the mills today market their many products throughout the West. The mills are located at Pueblo because of the combined site advantages of the availability of several railroads for products shipment, water from the Arkansas River, and nearby coal.

FIG. 5

RELATIVE AREAS OF LAND WITHIN THE ARKANSAS AND RED RIVER
BASINS ADMINISTERED BY THE BUREAU OF LAND MANAGEMENT IN
COLORADO, KANSAS, NEW MEXICO AND OKLAHOMA, 1961



The Arkansas and Red River Basins also include a part of the State of Texas, but the Bureau of Land Management does not administer any lands in these basins within Texas.

LANDS ADMINISTERED BY THE BUREAU OF LAND MANAGEMENT

Land area under the jurisdiction of the Bureau of Land Management in the Arkansas and Red River Basins west of the States of Arkansas, Louisiana and Missouri is 792,154 acres. This 792,154 acres is almost entirely within the Arkansas River Basin, 99½ percent being located there, with only one-half of one percent in the Red River Basin. Location of the 792,154 acres by states is shown graphically in figure 5. Lands administered by the Bureau of Land Management include unreserved or vacant public domain, withdrawals from the public domain, and Choctaw-Chickasaw acquired lands. Vacant public domain lands are subject to all forms of disposal or entry if they may be so classified. Public domain lands in withdrawal status cannot be sold and their use is restricted or reserved by law for certain purposes such as power sites, stock drive-ways, public water reserves or reclamation.

Location of Bureau of Land Management Lands

Lands described in this report are limited to the Arkansas and Red River Basins in the States of Colorado, Kansas, New Mexico and Oklahoma. Only a small area of public domain remains in the other states of the tribasin area--Arkansas, Louisiana and Missouri. The Bureau of Land Management administers 792,154 acres of land within the Arkansas and Red River Basins within Colorado, Kansas, New Mexico and Oklahoma. Part of Texas is also within this western part of the Arkansas and Red River Basins, but there are no lands administered by this Bureau within these Basins in Texas.

The Bureau of Land Management administers several types of Federal landownership status within the area. Lands administered include acquired Choctaw and Chicasaw coal lands in Oklahoma, and public domain lands. Public domain lands include vacant or unreserved lands and also those which have been withdrawn or reserved for various purposes. Amounts of the several types of landownership and their location by states are presented in table 2.

Unreserved Lands

The area of unreserved public domain in the Arkansas and Red River Basins in Colorado, Kansas, New Mexico and Oklahoma is 752,544 acres. Most of this is in the State of Colorado and over 70 percent is concentrated in Area 1 at the headwaters of the Arkansas

River. The rest of the unreserved public domain, which consists largely of isolated tracts that range in size from less than two to a few hundred acres, is scattered over eastern Colorado, northeastern New Mexico, and Oklahoma, with a small amount in southern Kansas. The public domain is distributed by river basins within the four states in approximately the following percentages: Arkansas 99 $\frac{1}{2}$ percent, Red one-half of one percent. Distribution of unreserved public domain by states is: Colorado 89.2 percent, New Mexico 7.6 percent, Oklahoma 3.0 percent, and Kansas 0.2 percent. Area of the unreserved public domain by states and watersheds is presented in table 2. Detailed descriptions of these tracts are available at the Bureau of Land Management offices in Denver for Colorado; in Santa Fe for New Mexico and Oklahoma; and in Cheyenne, Wyoming, for Kansas.

Withdrawn Lands

Public domain lands withdrawn from entry are all located within the State of Colorado. Area of each type of withdrawal is given in table 2. Total area of the withdrawn or reserved land in Colorado is 28,507 acres. Purpose of the withdrawal is designated by the title or type of reservation. Types of withdrawn lands by relative amounts are: Power Site, 49.6 percent; Reclamation, 39.1 percent; Stock Driveway, 4.9 percent; Public Water, 0.8 percent; all other, 5.6 percent. Withdrawn lands are usually administered by the Bureau of Land Management as the withdrawing agency has requested reservation for possible future use or for limited or occasional use of the surface of the area withdrawn. Whenever withdrawn lands are released by the withdrawing agency, the Bureau of Land Management classifies the land so that it may serve the highest public use.

Problems

The foremost problem confronting the Bureau in its administration of the renewable land resources of the basins is to manage the land resources so that they will yield the greatest benefit to the public. Transfer of the land to other ownership where it can be more efficiently administered may be advisable. Retention of landownership and intensified supervision by the Bureau of Land Management is desirable for most of the area.

The Bureau of Land Management usually retains those tracts which are so valuable for multiple uses and proper conservation that they may be regarded as being best suited for Federal ownership and management. In addition, the isolated tracts which are valuable for recreation, watershed protection, timber production, or other special or multiple use values will be retained in public ownership for manage-

Table 2.--Area of lands administered by the Bureau of Land Management in the Arkansas and Red River Basins within Colorado, Kansas, New Mexico and Oklahoma, 1961 (acres)

State	River Basin		Total Area
	Arkansas	Red	
Colorado:			
public domain			
vacant	671,396		671,396
withdrawal ^{1/}	28,507		28,507
Total--Colorado	699,903		699,903
Kansas:			
public domain	1,288		1,288
New Mexico:			
public domain	57,110		57,110
Oklahoma:			
public domain	18,750	4,000	22,750
Choctaw-Chickasaw			
acquired lands	10,891	212	11,103
Total--Oklahoma	29,641	4,212	33,853
Grand Total:	787,942	4,212	792,154

^{1/} Types of withdrawals and their areas in Colorado are:

Power site	14,145
Reclamation	11,136
Stock driveway	1,388
Public water	240
All other	1,598
Total:	28,507

ment and protection until such time as conditions dictate that their disposal will not be adverse to the public interest. Tracts small in area, scattered and isolated, or otherwise situated so that they are not readily capable of being effectively supervised by the Bureau of Land Management, will be considered for transfer to other ownership where they can be more effectively and efficiently administered in line with their highest use for the best ultimate public interest.

All public domain lands in the area have been examined to determine their resources and highest use. Retention or disposal of the land is based on many factors. Landownership pattern, size and concentration of the tracts, location, total acreage, and the relationship of the tract to adjacent private or public land are considered. Effect of a transfer of landownership upon the local economy is also taken into account. Management of the retained land will be directed toward instituting proper use and improvement measures to reach the long-time objectives of adequate watershed protection, resource conservation and best use for the long term interest of the public through proper conservation use and development of the resources.

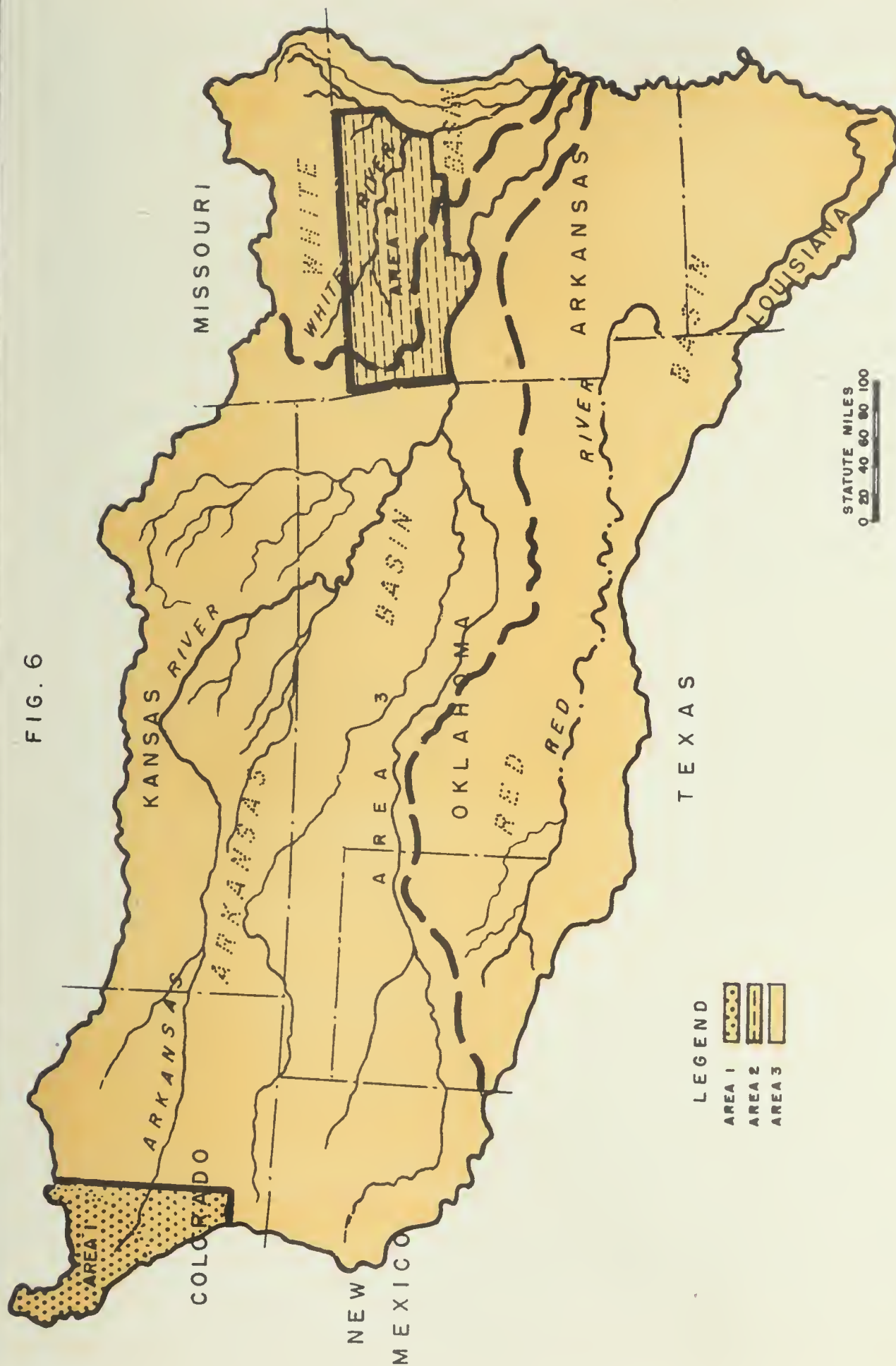
Land Use Suitability

Land use suitability refers to the use to which the land is adapted and for which it should be used to fulfill its highest purpose under the prevailing physical characteristics and long-time economic conditions. Public domain in the Arkansas and Red River Basins in Colorado and New Mexico is used principally for grazing in conjunction with the livestock operations of adjoining private lands. All of the tracts are valuable for watershed and wildlife. Timber production is a major use for a considerable area in the mountains. These uses are the highest utilization for most of the tracts. Some favorably located tracts are especially suited for recreation, homesites, power or reservoir sites, or for other special uses.

The Three Subdivisions of Arkansas-White-Red River Basin Lands

Consideration of the problems of administration of the public domain over so vast a region and the future program for these lands in the Arkansas-White-Red River Basins has resulted in establishing three areas. For geographic location of these numbered areas see Figure 6. Area 1 is in the mountainous upper reaches of the Arkansas River in Colorado; Area 2, in Arkansas, and Area 3, the balance of the area of the three basins. Area 1 contains 74.2 percent of the public domain west of the State of Arkansas in the three basins, and is the area considered in this report. Area 2 was considered to be a public domain land disposal area and this program has been virtually completed there.

FIG. 6



ARKANSAS-WHITE-RED BASINS
PROGRAM AREAS
BUREAU OF LAND MANAGEMENT

This report does not consider the small amount of public domain remaining in Arkansas, Louisiana and Missouri within Areas 2 and 3 as shown in figure 6. Information relative to the small tracts of public domain in these three states is available from the Eastern States Office of the Bureau of Land Management, Department of the Interior, Washington 25, D. C.

Public domain constitutes only a fraction of one percent of the total area in Area 3. As a rule the public land is in small widely scattered tracts dispersed over the basin from the Arkansas-Oklahoma State line westward to the Rocky Mountains. These tracts have been used in conjunction with the farm or ranch unit to which they are adjacent. Proper administration of these small scattered tracts by the Bureau of Land Management is difficult and may be expensive. Unless disposal is adverse to the public interest, emphasis will be placed upon the transfer of these lands to other ownership. Tracts of value for recreation or other special use will be retained or transferred to an agency which will properly administer them. First consideration will be given to transferring the land to other Government agencies but if no interest is shown by these agencies, the tracts may be offered for sale or exchange to private interests.

Public domain land suited for retention and administration is located in Colorado on the headwaters of the Arkansas and Huerfano rivers and is designated as Area 1 in figure 6. Character of the land resources, multiple use values, and proper use and conservation of the land resources favor continued Federal ownership and administration of the public domain within Area 1. The large area of public domain in Area 1, and the pattern of landownership largely justify retention and continued administration of the public domain there by the Bureau of Land Management.

Most of the public domain in Area 1 is at present embraced within the Colorado Grazing District No. 5. The district boundary should be extended to encompass most of the remaining public domain, especially that which is fairly well concentrated and in blocks of sufficient size to be effectively administered under a grazing district. Small isolated tracts in Area 1 located within private holdings and lacking special use values should be used when possible as a basis for exchange to improve the landownership pattern. Where an exchange is not feasible such tracts should, where suitable, be transferred to other Government agencies or sold to the public. Lands with favorable location for public use or tracts with special use values should be retained in public ownership and administration.

AREA 1, ARKANSAS, WHITE, AND RED RIVER BASINS

Location

Lands administered by the Bureau of Land Management in the Arkansas-White-Red River Basins are concentrated in the upper mountainous portion of the Arkansas River drainage. This headwater drainage of the Arkansas River, including the tributary Huerfano River, includes Chaffee, Custer, Fremont, and Lake Counties, and part of Huerfano County in central Colorado. This region, designated as Area 1, is shown with landownership status in figure 8. Location of the region within the three river basins is shown in figure 6. Western boundary of Area 1 is the Continental Divide in the Rocky Mountains. The beautiful Sangre De Cristo Range between the Arkansas and Rio Grande drainages is the southern part of the Continental Divide in the area. Northward, west of the headwaters of the Arkansas, eleven mountain peaks tower above 14,000 feet on the Continental Divide, including Mount Elbert, 14,431 feet above sea level, the highest point in Colorado and the second highest mountain in the United States. Northern boundary is Tennessee Pass and Fremont Pass, 11,318 feet elevation at Climax, site of the world's largest molybdenum mine. Balance of the northern boundary is the mountain divide between South Park of the South Platte drainage and the Arkansas River drainage. Southern boundary is the township line between townships 30 and 31 south. Eastern boundary is the range line between ranges 67 and 68 west, Sixth Principal Meridian.

Natural Resources

Principal resources of Area 1 are the farm land, grazing land, minerals, scenery and climate. Other important resources are the waters of the Arkansas and Huerfano Rivers whose tributaries arise in the higher elevations. This water supply is important for domestic, industrial and irrigation farming use. These watersheds are the lifeline of the Arkansas Valley in southeastern Colorado and supply water for use within the valley in Kansas and Oklahoma. Mineral resources of molybdenum, oil, gas, gold, silver, uranium, fluorspar, zinc, coal, bentonite, clays, gravel, sand and stone are important.

The rough and mountainous character of Area 1 is a natural habitat for numerous wildlife species and upland game birds. The many streams and lakes afford excellent fishing waters. These, combined with the natural scenic beauty of the area, are considered one of the most important potential recreational resource areas in Colorado. Forest and woodland stands are important to the lumber industry, supplying the demands of small mill operations. Location of Area 1 along principal transcontinental and interstate rail and highway routes is important to its economic development and growth. These routes

provide access to markets as well as to the recreational and other resources of the area. Tourism, both within and across the area, is an important phase of the area economy.

Range lands of the area include the rough breaks along the Arkansas and Huerfano Rivers, the valley floors of both rivers, the plateau and foothills of the upper Texas, Grape, Cottonwood, Beaver, Red, Oil, Currant and Badger Creeks. Range lands were inventoried and mapped as shown on the three vegetative type maps with this report. Principal range plants of Area 1 are listed with their scientific and common names in Appendix A. Range type designations of the vegetative types in Area 1 are listed and defined in Appendix B. Estimated grazing capacity of the 563,700 acres of public domain lands within Area 1 for both livestock and big game in 1961 is 42,188 animal unit months. An animal unit month is the amount of forage necessary to adequately support one cow, or one steer, or five sheep, for one month.

Resource inventory of Area 1 as shown on the 12 maps with this report was restricted to Colorado Grazing District 5 and to two other areas of concentrated public domain landownership. One of these areas extends from Salida in Chaffee County to the divide above Leadville in Lake County and has been named and mapped as the Leadville Area. The third area mapped is the western part of Huerfano County and is designated the Huerfano Area. There are four types of maps of each of three areas in the map pocket of this report. The resource inventory omitted most of Custer County and all of El Paso and Pueblo Counties within Area 1. Area of public domain within some counties has been reduced by recompilation and disposal since the resource inventory was made.

Physical Features

Most of Area 1 is very mountainous and rough. Elevations range from 5,000 feet to more than 14,000 feet and often these great variations occur within relatively short horizontal distances. The higher lands are very steep and near the rivers the land has been eroded into steep rugged breaks. Between the mountains and the river breaks there are numerous mountain parks and valleys with some plateaus with moderate slopes. There are approximately 511,770 acres with slopes of less than 25 percent, about 818,534 acres with slopes between 25 and 50 percent, and some 250,491 acres where slopes exceed 50 percent. The soils are varied and formed largely from rocks of the Pre-Cambrian Complex, including granites, gneisses and schists which comprise about 70 percent of the rocks in the area. Rocks of volcanic origin, including basalts, andesites and volcanic ash constitute about 10 percent of the rocks. Sediments which include limestone, shale and sandstone,

Table 3.- Climatic data for thirteen stations in or near Area 1, Arkansas-White-Red River Basins, Colorado, 1960^{1/}

Station Location ^{2/}	Elevation ft. above MSL	Temperature (Degrees Fahrenheit)					Growing Season Average Frost-Free Days	Average Precipitation		
		Maxi- mum	Mini- mum	January Average	July Average	Annual Average		Annual	Growing Season	
									May 1 through Sept. 30	April 1 through Sept. 30
Pueblo: Sec. 36, T. 20 S., R. 65 W., Sixth Principal Meridian	4,685	104	-27	29.4	73.3	51.5	174	11.87	7.47	8.71
Canon City: Sec. 32, T. 18 S., R. 70 W., Sixth Principal Meridian	5,343	104	-30	36.7	76.1	54.9	168	12.03	7.13	8.75
Huerfano: Sec. 14, T. 26 S., R. 66 W., Sixth Principal Meridian	6,010	105	-42	28.9	70.3	48.8	131	14.93	7.95	9.73
Colorado Springs: Sec. 18, T. 14 S., R. 66 W., Sixth Principal Meridian	6,098	98	-27	28.8	71.2	49.1	148	14.26	10.33	11.73
Walsenburg: Sec. 9, T. 28 S., R. 66 W., Sixth Principal Meridian	6,200	101	-25	32.8	71.2	51.9	155	14.46	7.33	9.55
Salida: Sec. 5, T. 49 N., R. 9 E., New Mexico Prin. Meridian	7,050	100	-33	27.3	65.3	45.7	113	10.80	6.00	7.26
Westcliffe: Sec. 17, T. 22 S., R. 72 W., Sixth Principal Meridian	7,860	96	-54	23.6	63.1	42.9	99	16.86	9.08	11.38
Buena Vista: Sec. 8, T. 14 S., R. 78 W., Sixth Principal Meridian	7,954	105	-37	24.4	63.3	43.6	108	9.65	5.53	6.61
Cuchera Camps: Sec. 4, T. 30 S., R. 69 W., Sixth Principal Meridian	8,200							23.73	11.78	14.67
Victor: Sec. 22, T. 15 S., R. 69 W., Sixth Principal Meridian	10,100	92	-25	24.8	58.0	40.1	97	19.26	14.05	15.24
Leadville: Sec. 24, T. 9 S., R. 80 W., Sixth Principal Meridian	10,248	86	-31	17.9	57.3	36.2	80	18.92	9.27	11.10
Lake Moraine: Sec. 28, T. 14 S., R. 68 W., Sixth Principal Meridian	10,625	85	-37	19.4	54.5	35.7	75	24.35	19.60	21.84
Climax: Sec. 2, T. 8 S., R. 79 W., Sixth Principal Meridian	11,300	75	-25	15.3	51.0	31.2	68	29.03	11.03	13.80

1/ Stations are listed according to elevation. Precipitation increases with advancing elevation except where influenced by adjacent high mountains as within the Arkansas River Valley stations of Buena Vista, Leadville and Salida. Length of growing season and temperatures decrease with higher elevations. Four stations are east of Area 1: Colorado Springs, 6 miles; Walsenburg, 9 miles; Huerfano, 10 miles; and Pueblo, 18 miles eastward. These four stations provide data which is indicative for the eastern portion of Area 1. Data from climatic records of Colorado, United States Weather Bureau, Department of Commerce.

2/ Location is given by section, township and range. All townships in Area 1 are governed by the Sixth Principal Meridian except 38 townships in the general vicinity of Salida, Colorado, which are governed by the New Mexico Principal Meridian of the United States Cadastral Survey System. Sec. = Section; T = Township; R = Range; S = South; W = West; N = North; E = East. MSL = Mean Sea Level.

make up about 20 percent of the rocks in Area 1. On most of the steep slopes there is very little soil development, but on more favorable sites shallow soils have developed which are relatively low in productivity. The soils of the alluvial valleys are deep and vary in texture from coarse gravel to clay loam. Most of the more level valley soils are well drained and produce excellent crops if irrigated. The soils, which are very susceptible to erosion when devoid of vegetation, have eroded so extensively that large gullies are found in most of the tributary drainage ways. Numerous tracts previously farmed have been so severely eroded that they are no longer suitable for cropping. Quality and amount of both range forage and soil have been seriously diminished by erosion. Access to, and grazing use of, rangeland have been greatly interfered with by gully erosion. Soils in Area 1 are susceptible to erosion. Protective management and conservation practices are necessary to prevent erosion. Much natural geologic erosion exists within the more rugged and mountainous sections of Area 1.

Climate

Area 1 has a range of climate from subhumid in the high mountains to semi-arid in the lower altitudes. Normally, open winters are experienced at lower elevations. Snow accumulates in the higher mountains during winter and spring. Most of the precipitation is received during the growing season, including April, May, June, July, August and September. Weather Bureau records show that nearly three-fourths of the precipitation falls during these six months. Precipitation during the six months growing season varies from 48 percent at Climax, just north of Area 1, to 90 percent at Lake Moraine in the northeastern part. Lowest portion within the area is 59 percent at Leadville. Victor is a high station with 79 percent in the six months. Average of the 13 stations compiled is 68 percent of the precipitation falling during the six month growing season.

Storms of cloudburst intensity and duration with consequent flash floods frequently occur on the tributaries of the upper Arkansas during the spring, summer, and early fall months. Disastrous floods have swept through the upper Arkansas drainage causing particularly serious damage at Canon City, Florence, and Pueblo, Colorado. The evidence of these flood discharges is clearly indicated by the steeply cut banks, the ever-widening channel, and by flood debris cones present at the mouths of tributary streams. Records from 13 Weather Bureau stations in and near Area 1 are presented in table 3.

Vegetation

The natural plant associations in the Upper Arkansas Basin

range from grassland or prairie types on the fringes of the plains through the pinon-juniper zone with scattered parks at medium elevations, to the mountain browse with conifer and aspen types in the higher elevations. Grassland types extend up the narrow valley floors along the main drainages through the juniper zone almost to the conifer zone. The juniper type, which is probably the most extensive, is located in the rough and broken intermediate zone and is characterized by open "parks" supporting a fair to good understory of grasses, principally blue grama. The mountain browse zone is relatively small and is located immediately below the conifer timber zone. Much of the conifer timber in the area grows within the national forests in the higher mountain ranges of the upper reaches of the Arkansas River Basin.

The grazing land is of three large vegetal cover types; grassland, land with shrubs, and timber. Grassland covers 23.6 percent of Area 1. Grassland includes 371,955 acres of the grass type and 4,288 acres of meadow. Land with shrubs makes up 12.7 percent of the area. There are 76,204 acres of sagebrush, 115,626 acres of mountain brush, and 10,886 acres of saltbush and greasewood. The timber type constitutes 48.6 percent of the area, 210,159 acres being in coniferous timber, 490,109 acres in pinon-juniper stands, and 74,256 acres in aspen cover. Waste and barren land make up 9.7 percent or 154,948 acres, cities and towns occupy 12,158 acres, and cropland 72,364 acres. Most of the cropland is used to produce hay for livestock within the area. The locations of the various types and their relationship to each other are shown on the three vegetative type maps with this report.

Area of the ten range types in Area 1 and the recommended stocking rate for each type is presented in table 4. The average number of acres required to furnish one animal unit month of forage is also given for each range type. Landownership area of Bureau of Land Management land, State owned lands and privately owned lands in each of the ten range types is shown in table 5, along with the recommended stocking rate. Range types are defined in Appendix B.

Relative quality of land in the three types of landownership is shown in table 4. Bureau of Land Management lands make up 37 percent of the total area of rangelands within Area 1, but produce only 25.9 percent of the total range forage as expressed in animal unit months of proper stocking. State owned lands cover 6.3 percent of the total rangeland area and furnish 6.7 percent of the range forage. Privately owned lands comprise 56.7 percent of the area and supply 67.4 percent of the range forage. This range of quality is a result of the selection of the best lands in the former public domain for homesteading, leaving only the poorer lands in public ownership.

FIG. 7

LAND OWNERSHIP IN UPPER ARKANSAS BASIN - AREA I.

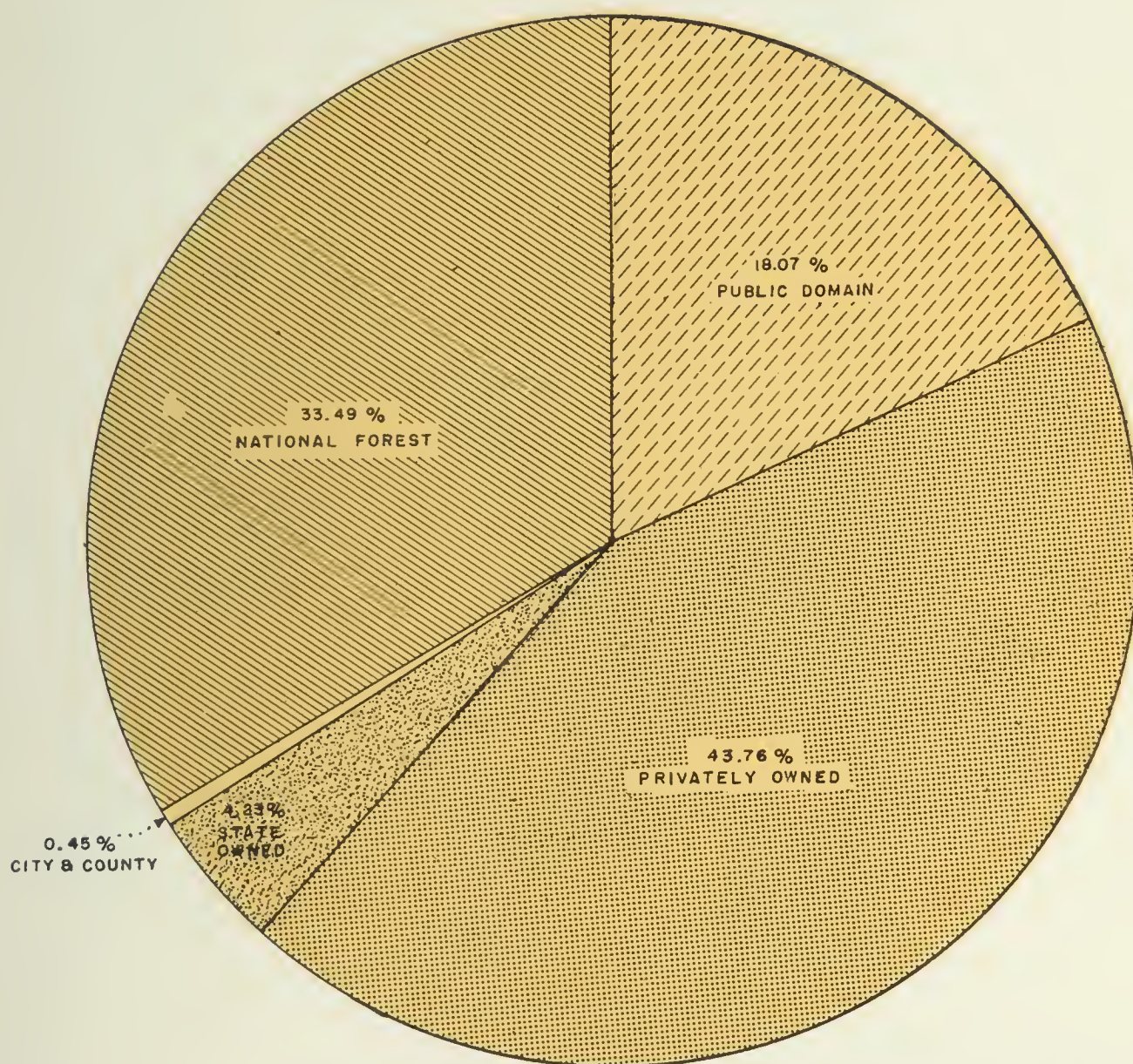
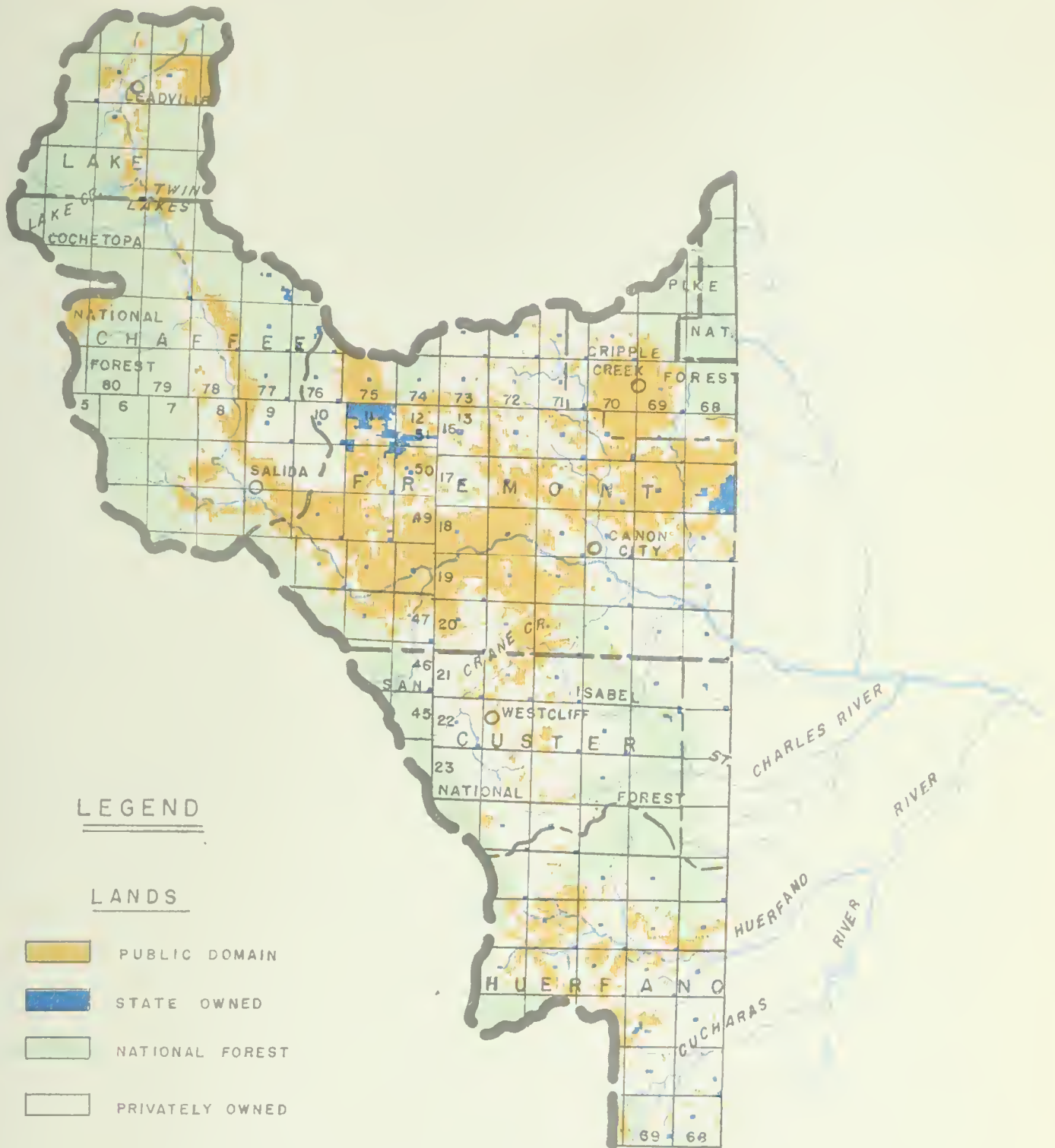


FIG. 8



LEGEND

LANDS

- PUBLIC DOMAIN
- STATE OWNED
- NATIONAL FOREST
- PRIVATELY OWNED

TOPOGRAPHY

- RIVERS
- INTERMITTANT STREAMS
- LAKES



LAND STATUS

AREA I

BUREAU OF LAND MANAGEMENT

Landownership and Public Domain

Public domain in Area 1 comprises a little more than one-half million acres, which is about 18 percent of the total area. More than twice this acreage, or 44 percent of Area 1, is privately owned; 34 percent is national forest and 4 percent is State land. Relative amounts of the five types of landownership are shown graphically in figure 7. Public domain within Area 1 and within the three areas which were surveyed and mapped is distributed by counties as follows:

<u>County:</u>	<u>Gross, 1961:</u>	<u>Area inventoried as shown on the 12 maps with this report:</u>
Fremont	344,389	345,986
Huerfano	70,450	70,450
Chaffee	51,177	54,652
Teller	33,913	33,913
Park	29,266	29,266
Custer	16,040	9,227
Lake	13,625	14,934
El Paso	3,211	
Pueblo	1,629	
Total	563,700	558,428

The area inventoried as shown on the 12 maps with this report consists of the three sub-areas; Colorado Grazing District 5, Huerfano Area and the Leadville Area.

Most of the public domain land in the counties listed above is in large blocks and can be efficiently managed. Some small private holdings are adjacent to, or surrounded by, public domain. Some small tracts of public land are surrounded by large blocks of private land. Generally both the public domain and private lands are in units of relatively large size. Public domain, national forest, State and private landownerships in Area 1 are shown in color in figure 8. Specific location of public land by legal subdivision is shown in color on the three land status maps with this report. Landownership is also shown on the black base of the 12 large maps with this report.

Table 4. -- Area and recommended stocking rate of range types on the rangeland in Area 1, Arkansas, White and Red River Basins, Colorado, 1953

Range type ^{1/}	Area acres	Relative area of type (Percent)	Grazing capacity AUM ^{2/}	Acres required per AUM ^{2/}
1. Grass	371,955	23.3	48,727	7.6
2. Meadow	4,288	0.3	1,900	2.2
4. Sagebrush	76,204	4.8	8,260	9.2
5. Browse-shrub	115,626	7.2	10,852	10.6
6. Conifer Timber	210,159	13.2	17,249	12.2
9. Pinon-juniper	490,109	30.7	23,852	20.6
10. Aspen	74,256	4.7	7,888	9.4
13. Saltbush	6,393	0.4	317	20.1
14. Greasewood	4,493	0.3	243	18.5
Total grazing area	1,353,483	84.9	119,288	11.35
7. Waste and				
8. Barren	154,948	9.7		
Total rangeland	1,508,431	94.6	119,288	12.65
Cropland	72,364	4.5		
Water surface	2,569	0.2		
Cities & Towns	12,158	0.7		
Total land area	1,595,522	100.0	119,288	13.38

^{1/} Range types or Vegetative types are defined in Appendix A, Range type designations. Range types in Area 1 are shown in color on the three Vegetative Type Maps in the map pocket of this report.

^{2/} Animal unit month is the amount of forage necessary to adequately support one cow, one steer, or five sheep for one month. (AUM)

Table 5.--Landownership, area and recommended stocking in ten range types and landownership of non-range land in Area 1, Arkansas-White-Red River Basins, 1953^{1/}

	Area & Stocking	Public Domain	State	Private	Total Acres	AUM'S
1.Grass	Acres	82,056	31,145	258,754	371,955	
1.Grass	Aum's	9,529	3,996	35,202		48,727
2.Meadow	Acres	304	213	3,771	4,288	
2.Meadow	Aum's	97	83	1,720		1,900
4.Sagebrush	Acres	6,992	6,096	63,116	76,204	
4.Sagebrush	Aum's	723	762	6,775		8,260
5.Browse-Shrub	Acres	39,524	5,562	70,540	115,626	
5.Browse-Shrub	Aum's	3,054	472	7,326		10,852
6.Conifer-Timber	Acres	57,557	8,219	144,383	210,159	
6.Conifer-Timber	Aum's	4,568	626	12,055		17,249
9.Pinon-juniper	Acres	255,514	29,047	205,548	490,109	
9.Pinon-juniper	Aum's	10,734	1,531	11,587		23,852
10.Aspen	Acres	21,717	4,437	48,102	74,256	
10.Aspen	Aum's	2,193	514	5,181		7,888
13.Saltbush &)	Acres	800	222	9,864	10,886	
14.Greasewood)	Aum's	36	10	514		560
Total grazing area, Acres		464,464	84,941	804,078	1,353,483	119,288
7.Waste and)						
8.Barren)	Acres	93,518	9,943	51,487	154,948	
Total rangeland)	Acres	557,982	94,884	855,565	1,508,431	
(grazing + 7 & 8)	Aum's	30,934	7,994	80,360		119,288
Cropland (III & IV)	Acres	446	273	71,645	72,364	no data
Water surface	Acres		10	2,559	2,569	
Cities & towns	Acres			12,158	12,158	
Total non-grazing	Acres	93,964	10,226	137,849	242,039	
Grand Total	Acres	558,428	95,167	941,927	1,595,522	
Rangeland production, Aum's, 30,934			7,994	80,360		119,288

^{1/} Recommended stocking of the rangeland is shown as animal unit months (aum's) of range forage which may be utilized. One animal unit month is the amount of forage necessary to adequately support one cow, one steer, or five sheep for one month. Most of the cultivated land is used to produce hay. No allowance has been made for feed production on cultivated land. The 1961 estimated proper grazing capacity for the entire 563,700 acres of public domain within Area 1 is 42,188 animal unit months for both domestic livestock and big game. This is 13.36 surface acres per animal unit month. The inventory of the three subdivisions of Area 1 as compiled above gives 30,934 aum's for livestock only on 558,428 acres or 18.05 surface acres per animal unit month.

LAND USE CAPABILITY

Lands in Area 1 have been inventoried and classified according to the standard land use capability classification. Land Use Capability Classes are described in appendix C. Area 1 Land Use Capability Classes are listed by area and relative amounts in three types of land-ownership in table 6. Land Use Capability Maps of the three subareas of Area 1 are in the map pocket of this report. These maps show land use capabilities ranging from class III to class VIII. These six classes were found in the following areas and relative amounts within the three subareas:

<u>Land Use Capability Class</u>	<u>Acres</u>	<u>Percent</u>
III	3,341	0.2
IV	60,125	3.8
V	50,347	3.2
VI	414,041	26.2
VII	898,225	56.8
VIII	154,716	9.8
All Classes:	<u>1,580,795</u>	<u>100.0</u>

Lands Adapted to Cultivation

Soil, topography, climate, and other factors in Area 1 limit the Land Use Capability of the land to no better than Class III. The land in cultivation is used mainly to produce hay, but a little grain is grown and some irrigated pasture is produced to supplement the range forage. Only on rare occasions are there attempts to grow crops without the aid of irrigation. The irrigation developments are on a small scale, usually of the single farm type with simple diversions and short ditches of low capacity.

Capability class III and IV lands are adapted to cultivation. Class III land is the lowest grade which is capable of constant cultivation. Class IV is fit only for occasional cultivation, its preferable use being for perennial hay or pasture. Class III land has 3,093 acres privately owned, 173 acres are State owned, and 75 acres are in Federal ownership, a total of 3,341 acres. Class IV lands are of such a nature that they are fit for cultivation only occasionally. Their most desirable use is for growing hay or permanent pasture. Some of the factors which relegate the land to this class are poor drainage, stones, low fertility, shallow soils, salinity, steep slope for cultivation, and other factors. In this class 59,602 acres are privately owned, 345 acres belong to the State, and 178 acres are public domain, making a total of 60,125 acres.

Table 6.--Land Use Capability classes by landownerships and relative amounts within Area 1 of the Arkansas, White and Red River Basins, Colorado, 1953^{1/}

Land Use Capability ^{2/} Class	Landownerships, acres			Total	
	BLM	State	Private	Acres	Percent
III	75	173	3,093	3,341	0.2
IV	178	345	59,602	60,125	3.8
V	5,116	3,988	41,243	50,347	3.2
VI	82,824	30,184	301,033	414,041	26.2
VII	376,298	50,671	471,256	898,225	56.8
VIII	93,937	9,931	50,848	154,716	9.8
Total	558,428	95,292	927,075	1,580,795	
Percent	35.3	6.0	58.7		100.0

^{1/} Rangeland or grazing land, waste and cropland are included in this tabulation. In addition there are 14,727 acres of water surface and townsite in Area 1, a total area of 1,595,522 acres.

^{2/} Land Use Capability classes are defined in Appendix C of this report.

Lands Adapted to Grazing and Forests

Land classes V to VII inclusive are adapted chiefly to grazing and to the production of forest products. Much of this land is adapted only to grazing but no land was found in this study area which is suited solely to the production of timber. Some timbered areas have considerable value for lumber and other forest products which they produce. All of the classes adapted to grazing have areas of timber. Much of the timber lands are of a quality to justify increased supervision and management. Class V land has fairly level topography and good soil but is not cultivated because of insufficient precipitation, lack of irrigation water or some other deterrent such as surface obstacles, alkali, or poor drainage. The vegetation on this land usually has a density in excess of 30 percent and has good vigor and a high production potential. Soil erosion is not a problem and proper management is the only requisite for continued high production. The ownership of class V land is divided as follows: 5,116 acres public domain, 3,988 acres State, and 41,243 acres private, a total of 50,347 acres.

Class VI land is moderate in slope, up to 20 percent, with somewhat shallower soils of poorer quality than the soils in Class V. The surface may be irregular with some stones or rocks. These lands have vegetative densities upwards of 30 percent of moderate yielding forage. The land is moderately vulnerable to erosion and may show slight erosion with occasional gullies. Usually, moderate restrictions in use are all that will be required to maintain production and arrest erosion. Deteriorated or depleted lands in this class may require major restrictions in use and some rehabilitation practices, especially reseeding, to obtain recovery. There are 414,041 acres of land in this class, 82,824 acres of which are public domain, 30,184 acres of State land, and 301,033 acres are private land.

Class VII land, as a rule, is steeply rolling to rough and broken with slopes and grades in excess of those in Class VI. Lands with gentle slopes may fall in this class because of sandy texture, poor cover or high erosion potential. Soils of class VII land are usually highly susceptible to erosion. Frequently class VII land is in a stage of severe accelerated or normal erosion. Soils are usually shallow or otherwise restricted in quality and the vegetation usually is sparse with less than 30 percent density. Forage is frequently low in quality or quantity or with a short season of use so that an animal unit month usually requires in excess of ten acres under proper range management. Class VII lands have critical areas that should be restricted in grazing use because of the steep slopes and the susceptibility of the vegetation and soil to deterioration under excessive disturbance. Improper grazing use on these slopes with unstable soils can result in severe damage to the watershed.

Such areas should be used for livestock grazing only under drastic restrictions in numbers and seasonal use. Intense soil and moisture conservation measures may be justified on these critical lands. These critical areas should be managed for the same purpose as are the Class VIII lands, namely, for the purpose of watershed protection. Within the noncritical areas of Class VII are timber areas which produce wood products such as saw timber, posts, poles, or firewood, in addition to forage. Class VII lands cover 898,225 acres, which is 56.8 percent of the study area. These lands are mostly in the breaks adjacent to the Arkansas and Huerfano Rivers. Landownership is 471,256 acres of private land, 50,671 acres of State land, and 376,298 acres of public domain. Public domain is 41.9 percent, private land comprises 52.5 percent, and the State land makes up 5.6 percent of the Class VII land.

Lands Primarily Valuable for Watershed, Wildlife, and Recreation

Class VIII lands usually have steep rocky slopes with poorly developed shallow soils which support only a meager stand of vegetation. Any soil on the site is usually extremely vulnerable to all sorts of disturbance and erosion. Class VIII lands originate much of the runoff, erosion and sediment. Best class VIII sites may have fair amounts of woodland, brush or even grass. Generally, the vegetation other than scrub trees is sparse. These lands have no potential for domestic livestock grazing. Livestock use should be eliminated and the harvest of timber products stopped or curtailed to the extent that soil and vegetation are not adversely affected. Game use of these areas should be managed so that game use does not cause watershed deterioration.

Proper management of the resources will bring about substantial improvement in the quality and quantity of the vegetal cover, both forage and timber. In many areas the increase will be in excess of 25 percent; in other areas little or no improvement can be expected. Increasing the vegetation will markedly reduce the runoff by increasing infiltration. It has been found that in general the infiltration rate for good grass sites is at least twice as high as it is for poor weed sites. Considerable improvement has been effected since the inventory was made in 1953. The best feasible conservation program should be utilized with emphasis on watershed protection. Recreation and wildlife activities may become a secondary land use if they do not endanger the watershed protection program.

Table 7. -- Forest types, qualities, and products as shown by the five digit numbers on the Huerfano Area Vegetation Type Map, Area 1, Arkansas-White-Red River Basins, Colorado, 1953

First digit	Second digit	Third digit	Fourth digit	Fifth digit
Forest type	Accessibility and use	Age	Products available	Distribution of products
1. Juniper	1. inaccessible	1. all ages	1. soil protection only	1. uniform
2. Pinon-Juniper	2. inaccessible-- feasible to open	2. over-mature	2. immature	2. patches
3. Pinon pine	3. accessible-- virgin stand	3. mature	3. 0-10 posts/a.	3. zoned
4. Ponderosa pine	4. accessible-- partially cut	4. intermediate	4. 11-20 posts/a.	
5. Douglasfir	5. accessible-- cut out	5. young	5. 21-50 posts/a.	
6. Engelmann spruce		6. bug killed	6. over 50 posts/a.	
7. Spruce-Lodgepole- pine		7. fire-killed	7. poles	
8. Lodgepole pine		8. invasion type	8. pulpwood	
9. Aspen			9. saw timber	
0. White fir, Alpine fir			0. Christmas trees	

LAND RESOURCE VALUES, USES, AND MANAGEMENT

Grazing

The entire area, excluding townsites, waste and cultivated land, is used for livestock grazing. The cultivated lands produce much of the supplemental livestock feed. Public domain range lands have been classified for proper seasons of use. The low prairie ranges and areas along the Huerfano and Arkansas Rivers are winter and spring ranges, used in connection with the private ranch lands during the winter season and calving operations. Ranges between elevations of 6000 to 7000 feet are best adapted to spring-fall use and range lands above 7000 feet are better suited to summer use.

Approximately 20,000 cattle and 6,000 sheep are now licensed on the public domain lands in Area 1. Grazing use has been adjusted to the estimated grazing capacities of the public lands and grazing management and supervision has brought the grazing use in line with available range forage supplies.

Forest Management

The three vegetative type maps with this report show about 774,500 acres of forest types. There are 490,100 acres classified as woodland, 210,200 acres classified as coniferous timber, and 74,200 acres classified as aspen. The woodlands are located mainly on the lower mountain slopes and the breaks near the two larger rivers. Coniferous timber and aspen are located at the higher elevations. Forest resource inventory is shown on the Huerfano Area Vegetation Type Map by means of a series of five digits which are explained in table 7.

Forest management is a significant part of multiple resource management in Area 1. This is a relatively new concept for southeastern Colorado. Before 1956 little was known as to quantity and quality of forest products in this area. As public demand increased for forest resource sales, it became apparent that additional personnel would be needed to prepare and supervise forestry operations. In 1956 one Forester was added to the District Office of the Bureau of Land Management at Canon City. The best 1961 estimates have been gained through field reconnaissance. These inventories distinguish between commercial forest land and pinon-juniper land. It is now estimated that there are approximately 90,000 acres of public domain with commercial forest land supporting forest products of varying degrees of stocking and age. Approximately 350,000 acres of public domain support light, medium and dense stands of pinon-juniper trees. Compared to

the total of 563,700 acres, this means that approximately 78 percent of the public domain in Area 1 is supporting some form of forest products.

Commercial forest management in this area has three main phases which, if practiced, will enable the forests to continue to produce the maximum quantity and quality of wood fiber. The first phase is a detailed forest inventory which has been initiated and is expected to be completed in 1963. The results of this inventory will be used to establish a long range sustained yield management plan.

The second phase of the Area 1 program is forest product sales. Mature and overmature timber is being harvested at the rate of 3,000,000 to 4,000,000 board feet per year. These sales are returning revenue of approximately \$35,000 to \$40,000 to the United States Treasury each year. In addition, sales of firewood and mine timbers have aided in timber stand improvement projects as well as producing revenue and promoting the local economy and employment. Thirty or more sales are now being made each year to small wood using industries. The policy of selling small quantities of products has served to aid the forestry program as well as aiding local economics.

The third phase of Area 1 forest management is one of forest rehabilitation. This program is in the planning stage. The program will be activated when funds and personnel are provided. Reforestation as well as timber stand improvement are sorely needed to bring the public domain forest lands up to maximum production. Increasing local demand for forest products means that every acre of land should be producing at its maximum rate. Colorado Grazing District 5 is attempting to reach this goal within the limits of appropriated funds.

The 350,000 acres of public domain supporting a pinon-juniper forest type is located in the Upper Arkansas River drainage. Portions of this have been classified as waste or badlands, supporting only juniper or pinon-juniper cover devoid of palatable range forage. With technological advances in remanufacturing products from wood fiber, it is conceivable that no land should be considered waste for future generations. At present there is demand for firewood, fence posts, Christmas trees and a possibility of a charcoal industry being established to utilize pinon and juniper wood.

The future promises a continued demand for forest products in industry with an increase in value. Sustained yield forest management will be integrated with an expanding recreation and access roads program to all public lands. Developing marginal lands to their maximum potential production is a challenge but it can and should be done by the Bureau of Land Management.

Fire Protection

History has shown that fire can be a serious problem in Area 1. Reviewing the acreage denuded by fire, damage to watershed and improvements, and occurrence of fires, it is revealed that the problem has not developed to serious proportions. This is shown by the record of less than 1000 acres having been burned in Area 1 since 1950 while the total public land under protection exceeds 718,000 acres.

The public land outside the National Forest varies as to terrain, fuel types, accessibility for fire fighting equipment and landownership pattern. These conditions dictate a decentralized fire fighting organization. Since 1950, key fire danger localities have been designated due to occurrence of fires as well as fuel types. Lack of appropriated funds and trained men requires a cooperative system of Per Diem Guards and tool caches well distributed throughout Area 1. Initial fire fighting action by local landowners is usually reinforced by men and equipment from the district headquarters.

The past fire organization has been refined and modernized as a result of improved fire danger weather forecasting and a district wide radio communication system. Aerial reconnaissance with an improved road network to most public lands permits fast fire appraisal and fire suppression. The rough terrain still requires maximum man hours with hand tools and minimum use of heavy equipment. The fire organization also includes a local supply of young well trained fire fighters for fast, efficient action.

The future forecast is one of increasing value of natural resources as well as increased use of Federal land by the public. It can be expected that man caused fires will continue in spite of an enlarged education program. As appropriated funds and trained men become available, the Bureau of Land Management can be expected to provide maximum protection to keep pace with a growing fire problem.

Wildlife

The Arkansas and Huerfano River Watersheds contain a wide variety of wildlife habitat types, and considerable wildlife. Big game species are mule deer, elk, antelope, mountain sheep and bear. Upland game birds are pheasant, turkey, grouse, chukars, and quail. Migratory waterfowl, ducks and geese are found in the larger lakes and streams to a limited degree. Mule deer, the principal big game specie, are common throughout the entire area. The estimated deer population for Area 1 is 10,000. Elk are found in the higher mountainous timbered and park types, particularly the Waugh Mountain range, along the

Sangre de Cristo Mountain range, the Leadville area and in the Cripple Creek region. Antelope are found on the open plateau ranges near Guffey.

Mountain sheep range in the rough, rocky breaks along the Arkansas River and the northern portion of the Sangre de Cristo mountains. Bear seem to be common in the browse and mountain ranges of Area 1. Pheasant, chukars and turkeys have been introduced into the area. Pheasants are found in the vicinity of cultivation. Chukars were planted in the Salida area. Wild turkeys are found in the Cooper Mountain and Tallahassee Creek Range. Grouse are found in the sagebrush grassland areas and quail inhabit the southern portion of Area 1.

Fur bearers in the area are skunk, badger, fox, beaver, muskrat and jackrabbit. None have economic significance. The area is relatively free from prairie dogs. Gophers are troublesome on both mountain meadows and cultivated land. Predators consist of coyotes, bobcats and mountain lions.

The waters of the Arkansas and Huerfano Rivers, the lakes and many streams in Area 1 are considered excellent fishing waters. Among game fish, trout is the important specie. Lake fish consist of bass, pike, Kokanee salmon, crappies and bullheads. Rough fish such as carp, suckers and chubs are a problem in some waters.

Recreation

Area 1 has huge recreational potentials. One of the principal recreational activities is hunting. Generally the entire area is open during game seasons. Several thousand sportsmen utilize the range lands, both private and Federal, every year. Fishing is another important sport and the rivers, streams and lakes in Area 1 provide excellent fishing waters for tourists and the populated areas of Denver, Colorado Springs, Pueblo and the southeast section of Colorado. Yearlong fishing is available in the Arkansas River.

The Royal Gorge Bridge and Park located on the Arkansas River near Canon City attract thousands of visitors to the area annually. Cripple Creek and Leadville are famous historic mining communities that attract many tourists to the area to also enjoy the scenic and recreational resources of the surrounding mountain and range areas.

Throughout Area 1, many small areas on Federal land have been examined and recommended for development as camp and picnic sites. These vary in size from one acre spots for roadside-wayside rest stops to 400 acres available for camp and picnic facilities.

These areas have been proposed for development as local, State and Federal projects. These numerous sites will provide excellent facilities for the growing need and demand for public recreation. Wayside rest areas, picnic and camp areas will provide accommodations for general outdoor recreation. Fishing and hunting parties and water sports enthusiasts will be accommodated by sites at several lakes. One area is recommended for winter sports development. Area 1 will increase in popularity and public demand for recreational purposes, so the public lands should be preserved in Federal ownership for future public use and enjoyment.

Watershed

Although Area 1 is of great worth for livestock grazing, as a big game habitat, for timber production and for the recreation which it furnishes, probably its highest use is to function as a protective watershed. Lands of Area 1 should be managed to give the fullest protection from floods and sediment production. Proper conservation management of Area 1 lands will furnish an optimum of forage, timber and good quality water. Considering values within the area and the importance of downstream irrigation, industrial and domestic use, watershed is probably the greatest value of Area 1 lands.

RANGE CONDITION

Range condition is a measure of the general thrift of the present vegetation and the stability of the soil in comparison to the optimum for the site. Areas are classed as excellent if the soils are free from noticeable accelerated erosion and vegetation is near the climax stage with good vigor and optimum production. Areas with only minor accelerated erosion and from 10 to 25 percent reduction in vigor or volume are classed as good. Where there is moderate accelerated erosion on much of the area and the climax vegetation is being replaced to a considerable degree by less desirable plants, and the quality and quantity of the vegetation are reduced from 25 to 50 percent, the area has been classed as fair. Areas on which the accelerated erosion has advanced to the stage where numerous gullies and severe sheet erosion have developed, or on which the vegetation has been depleted in quality and quantity to less than 50 percent of the optimum, are classed as poor. During the inventory of 1953, good, fair and poor condition classes were found on the grazing land of Area 1. These classes and the acreages in each within three types of landownership are shown in table 8.

There is a very close relationship between cover and condition class. A comparison between the two general range types, range and

timber, shows that the poorer condition is associated with those areas on which forage plants are the dominant plant cover. Trees in the woodland range type grow in open stands with an understory of forage species, mainly grass. Type and intensity of use on the woodland range type has been the same as that on the grass type.

Because of heavy grazing use the open woodland type probably should be considered along with the grass type when making comparisons between condition class and range types. If this is done the relation between range types and condition class is very striking. The grass and grass-brush range types showed the greatest decline in vigor and volume and had departed farthest from the climax stage. Deterioration had progressed until, in 1953, the ranges were producing only a fraction of what they had once produced or of what they were capable of producing. In 1961 considerable improvement was evidenced due to climatic conditions and good management. The timber types showed less decline in vigor and were nearer the climax for the site than were the grass and grass-brush types. Timber reproduction was not all that could be desired, and the density of the vegetation and litter volume could have been greatly improved, especially in the open stands. Favorable climatic conditions and better management are beginning to improve the timber types, both for forage and timber.

Table 8--Range condition class of grazing land
by landownership, Area 1, Arkansas-White-Red
River Basins, Colorado, 1953

Range condition Class ^{1/}	Landownership, Acres ^{2/}				Percent
	BLM	State	Private	Total	
Poor	261,452	41,958	457,556	760,966	56
Fair	174,414	35,922	319,636	529,972	39
Good	28,598	7,061	26,886	62,545	5
Total	464,464	84,941	804,078	1,353,483	100

^{1/} Condition class is determined by the percent of the present plant composition that is considered to be climax vegetation for the site. Excellent condition has 76-100 percent of the present composition that is climax for the site: Good, 51-75 percent: Fair, 26-50 percent: Poor, 0-25 percent.

^{2/} 242,039 acres of waste, cropland, townsite, and water surface are not included.

EROSION

There is a striking parallel between range type and erosion, probably because range type and plant depletion are so closely associated. The severity of erosion has, in most cases, kept pace with the decline in plant vigor and density. Three types and the five degrees of erosion are defined in Appendix D. Although severe gully erosion is often found in areas where vegetation and soils are good, usually the origin of the water which contributes to the damage can be traced to areas, often some distance away, where the vegetation has been depleted and the soil disturbed. The three Erosion Maps with this report depict the location of erosion classes on each of the three subareas. Comparison of the Erosion and Vegetative Type Maps of each subarea shows the relationship between cover and erosion. Grass, weed, and open brush types are the most susceptible to accelerated erosion. Erosion class by range types and landownership is summarized in table 9. In addition to the lands listed in table 9, there are 72,364 acres in cultivation, 12,158 acres in townsites and 2,569 acres of water surface.

WATERSHED IMPAIRMENT PROBLEMS

Year-long grazing was the common practice of the livestock industry in Area 1. During the late 1800's, 60,000 to 80,000 head of cattle were kept year-round on the open range in this part of the Upper Arkansas Basin. Such excessive year-long use brought about some unfavorable changes in plant composition and reduced the volume of litter. The soil mantle, which nature had been ages in building, was reduced by erosion. The more desirable forage plants were weakened or destroyed, the plant residue or litter was destroyed, and the soil was compacted. The outcome of these rapid changes in nature's balance was a decrease in the infiltration rate of the soil and an increase in the surface runoff. As a result, the loss of topsoil has been excessive in nearly all areas accessible to livestock. Gullies have developed in most drainages as a result of increased water accumulation and movement.

Depletion of the soil and vegetation makes it extremely difficult to secure proper management with use. Improper use has resulted in severe on site damages in the upper watershed, but great as has been the damage in the headwater areas, the floods and sediment which originate on the depleted range have caused far greater damage along the lower reaches of the river. As a result of floods, several lives have been lost, untold suffering has been experienced, and hundreds of thousands of dollars in damages have occurred. Range improvement measures and supplemental structures, together with wise use and careful management practices are requisite to secure favorable results.

Table 9. --Maximum degree of soil erosion by range types and landownerships, Area 1, Arkansas-White-Red River Basins, Colorado, 1961^{1/}

		Soil Erosion Condition Classes			
	Landownership	Class 1	Class 2	Class 3	Total
1. Grass	BLM	42,357	39,184	515	82,056
	State	12,743	16,971	1,431	31,145
	Private	103,689	148,402	6,663	258,754
	Total	158,789	204,557	8,609	371,955
2. Meadow	BLM	190	114		304
	State	148	65		213
	Private	3,146	515	110	3,771
	Total	3,484	694	110	4,288
4. Sagebrush	BLM	6,298	333	361	6,992
	State	5,949		147	6,096
	Private	54,409	8,607	100	63,116
	Total	66,656	8,940	608	76,204
5. Browse-Shrub	BLM	26,226	13,298		39,524
	State	4,109	1,453		5,562
	Private	59,249	11,291		70,540
	Total	89,584	26,042		115,626
6. Conifer	BLM	47,762	9,795		57,557
	State	6,998	1,221		8,219
	Private	95,130	49,165	88	144,383
	Total	149,890	60,181	88	210,159
7. Waste &)	BLM	87,654	5,864		93,518
8. Barren)	State	8,357	1,586		9,943
	Private	48,001	3,486		51,487
	Total	144,012	10,936		154,948
9. Pinon-juniper	BLM	192,499	62,777	238	255,514
	State	20,147	7,633	1,267	29,047
	Private	152,063	52,216	1,269	205,548
	Total	364,709	122,626	2,774	490,109
10. Aspen	BLM	19,208	2,131	378	21,717
	State	4,337	70	30	4,437
	Private	41,967	5,520	615	48,102
	Total	65,512	7,721	1,023	74,256
13. Saltbush &)	BLM		417	383	800
14. Greasewood)	State		155	67	222
	Private	55	3,675	6,134	9,864
	Total	55	4,247	6,584	10,886
Totals	BLM	422,194	133,913	1,875	557,982
	State	62,788	29,154	2,942	94,884
	Private	557,709	282,877	14,979	855,565
Grand Totals		1,042,691	445,944	19,796	1,508,431

^{1/} Erosion maps of Colorado Grazing District 5, Huerfano Area and Leadville Area with this report show several combinations of degrees of erosion in the three classes of erosion: sheet, wind and gully. Combinations of degrees of erosion are shown in several colors and patterns on these maps. There is an explanation of each degree in all classes with the legends on the maps. Soil erosion condition classes are described and defined in Appendix B of this report.

LAND USE MALADJUSTMENTS

Prior to the passage of the Taylor Grazing Act in 1934, unrestricted grazing use contributed greatly to depletion of the forage resources. Subsequently, grazing capacity estimates and range surveys have been applied in an effort to bring use of the range in line with available forage supplies, and by so doing aid in re-establishment of the vegetal cover to stabilize soils and curb erosion. Because of rough topography livestock follow the natural tendency to concentrate and overgraze the more favored locations, usually the meadows and open grasslands of the gentle slopes, thus creating problem areas. The steep slopes, while less intensively grazed, usually have poorly developed soils that are extremely susceptible to erosion and therefore require careful management to preserve and improve watershed values.

The inventory of 1953 showed that three land use practices needed adjusting; overuse by livestock, improper seasonal use, and the use of lands not suited to grazing. Overuse and the resultant reduction in forage had no doubt led to the increased use of land before the time of vegetative readiness and also forced stock to seek feed on the steep rocky slopes not suited to grazing. Adjustments have been made and the range has been improving since the inventory was completed. Until recently the use of timber and woodland products was under only the most lenient of regulations. Timber products were exploited and no supervision was given to the orderly and wise harvest of the products. There existed a gross disregard for the preservation or perpetuation of the timber and no consideration whatever was given to maintaining a satisfactory watershed condition.

Damage that has resulted from past misuse has led to adjustment of the land use operations and management has been changed so as to improve all phases of the resources. Further increase of forage and timber production and prevention of soil and water loss will necessitate concentrated effort on the part of operators and managers alike. The correlated land use management is designed to promote maximum timber and forage production, to restore and maintain optimum watershed conditions from the standpoint of water yield, flood control, soil stabilization, and human needs. The utilization of the forage and timber resource to the maximum extent compatible with range and watershed improvement will necessitate an ever changing and dynamic program, challenging the highest ability of operators and managers. The varied uses will be correlated so as to produce a maximum of benefits to the people as a whole rather than to any one individual.

Landownership Pattern Adjustments and Disposal Problems

The complex pattern of landownership in Area 1 presents a difficult problem in administration and conservation. This landownership pattern is evident in figure 8 and the three land status maps with this report. There are small isolated tracts of public domain which are surrounded by private land and conversely, similar tracts of private land which are isolated in areas of public domain. Most of the small isolated tracts of both ownerships are chiefly valuable for grazing. Where the public domain is in fairly large blocks, effective administration poses no major problem.

In areas where public domain, private, and other land is more or less of a checkerboard pattern, proper use and effective administration become difficult. In many cases it will be feasible to make exchanges of isolated tracts and improve the landownership pattern to the extent that more efficient management will result. Laws which provide for the exchange or sale of the small tracts of public domain may be used in order to consolidate land into workable units, or to dispose of land to interests where it can be most effectively administered.

Administrative Problems

The public domain was seriously abused and misused prior to the passage of the Taylor Grazing Act in 1934. Rangelands were greatly overstocked and timber was exploited with no thought of the future welfare. Since the passage of this Act, the use of the public domain has been under regulation. All that is desired has not been accomplished but considerable progress has been made in resource management and in the installation of conservation measures on the public domain. This progress has been made by concentrating the effort on the most serious cases of resource abuse.

The public domain in Area 1 is being supervised with increasing efficiency through the cooperation of adjoining landholders who in most cases are using the public domain in conjunction with their ranching operations. Many remedial measures were needed on both public and private grazing land for abuse had not been confined to any specific ownership and deterioration had advanced alike on public and private land. Since the public domain and the private grazing land are so inseparably connected with the economy of the region and each are in need of similar management changes and land treatment measures, an inventory of land condition and needed improvements was made for all of Area 1. The improvement plan was developed for lands in need of special treatment regardless of ownership for it is impractical to treat land in one ownership only.

Through the cooperation of the Bureau of Land Management with private parties, extensive improvements have been made on the area, many of them on private land. Most of these improvements consist of live-stock watering places and range fences. The problem ahead is to secure proper stocking with correct seasonal use, together with additional management aids and conservation structures and practices.

Qualified livestock operators are permitted, under Section 4 of the Taylor Grazing Act, to construct and maintain fences, wells, watering facilities and other improvements needed to care for the permitted livestock on the public domain. Fences and stock watering places are the main improvements constructed.

The cost of programs for the operational phases of the range improvements have in some instances been borne by the range users, but the larger part of the cost has been borne by range improvement and soil and moisture conservation funds of the Bureau of Land Management. In addition to the improvements participated in by the Bureau, the landholders on their own initiative have installed many improvements.

Colorado Grazing District No. 5, which embraces a little more than 560,000 acres of public domain, is located in Area 1. Land use is under the laws and regulations pertaining to Grazing District management. The Fremont Soil Conservation District covers most of this Grazing District. Cooperation between these Districts works toward higher standards of land management within the Grazing District.

Progress is being made toward the desired goal on both public domain and other land, through cooperation with permittees and with adjacent land owners. Outside the grazing district where the public domain is under lease to qualified applicants less progress is being made. Extension of the boundaries of the present grazing district to embrace most of the public domain in Area 1 will make it easier to secure better management and more rapid watershed rehabilitation.

Inventory of Area 1 indicated that 56 percent of the grazing land in the area was in poor condition, 39 percent was in fair condition, and only 5 percent was in good condition. Range condition reflected the use and abuse prior to 1954, on public and private land alike. Management was more or less the same on both public and private land prior to 1950. Management of public domain land must be integrated with the management of adjacent interdependent land to benefit the economy of the area.

Optimum range condition, both from a forage production and a protective watershed standpoint and maintenance of the range in good or better condition, requires that the grazing and other uses should

be based upon the proper utilization of the resource. Wide variations in topography, range use and climate, especially in the timeliness, amount and effectiveness of precipitation for production of vegetation make it necessary that the ranges be periodically evaluated to determine condition and trend of vegetal and soil conditions. Grazing management applied on the basis of interpretation and evaluation of range condition and trend factors will assure that sufficient plant cover will be maintained to stabilize the soil and increase its infiltration capacity.

Land Treatment Measures

Plans for correcting the unsatisfactory condition of the watershed include good land conservation practices. Concentrated effort to follow such practices must be maintained by all who use or administer the resources to maintain and improve area resources. Several types of land treatment and management practices will be used to bring about optimum watershed conditions. Structures and practices will be adapted to remedy unsatisfactory conditions, and will be part of a coordinated plan to rehabilitate the watershed. The practices which will be stressed are those which will facilitate the establishment of optimum vegetation and which will minimize soil erosion.

Management is the only means of improving watershed conditions on some sites that have certain inherent limitations. Management alone will be sufficient to obtain the desired results on other sites. Where management alone is needed, no other practices will be employed. There are many places on which cover and soil conditions have so deteriorated that management alone will not suffice to improve watershed conditions. Restoration of the vegetation and stabilizing the soil would be too slow. Strict conservation practices and structures will be necessary in addition to good land management to effect the desired rehabilitation.

POTENTIAL IMPROVEMENTS FOR THE DEVELOPMENT AND MANAGEMENT OF THE PUBLIC DOMAIN

Resource Development

This section includes proposals for development of the range resource on the public domain within the limits of the Arkansas River Watershed in Colorado. The Bureau of Land Management's "Twenty Year Program of Range Conservation and Improvements" was used as a guide in the compilation of the summary of structures and land treatment practices recommended for control of soil erosion and water runoff, as presented in table 10. The Twenty Year Plan was initiated in 1954 and revised in 1959.

Numbers and types of proposed improvements, together with estimated costs, were taken from this 20-year plan and amended with the current plans for improvement of the outlying Section 15 lands which are within the jurisdiction of Colorado Grazing District 5, all of which are located within the limits of the Arkansas River Watershed. Some areas of the Watershed are well suited to land treatment. The possibilities for an appreciable increase in grazing capacity and a reasonable reduction in erosion can be expected with the timely application of the proposed projects. These conservation measures include fencing of grazing allotments, livestock water developments, water detention and retention structures, and the treatment and revegetation of low capacity range.

Livestock Water

Proposed livestock water facilities include reservoirs, wells, and the development of springs. The need for additional livestock water is general throughout the area. A more uniform distribution of livestock resulting from more stock watering facilities will allow more cover plants to grow and help prevent erosion. Most of the proposed spring developments are in the side drainages of the Arkansas River in Chaffee and Fremont Counties where the development of stock ponds is difficult due to the intense flash floods and sedimentation conditions which exist. Wells have been proposed only in those areas where ground water is believed available at a depth to make pumping of stock water economically feasible. Wells are proposed only in locations in which drainage patterns or site conditions make reservoir development difficult.

Waterspreading and Contour Furrows

Waterspreading will be carried out on a very limited scale in the lower limits of the Arkansas drainage within Area 1. Lower elevations are the only parts of the public domain in this Watershed that are flat enough to be suitable for this type of project. Contour dikes, check dams and contour furrows will be an integral part of the complete treatment of these lands. Similar areas of contour furrowing and waterspreading are planned in the Huerfano County area where considerable amounts of land can be treated in this manner.

Proposed erosion control structures have been confined to those areas where a combination of soil loss, low range forage production, and suitability for construction would lead to economically justifiable results. The large diversion and detention dams proposed are all to be used in conjunction with the proposed waterspreading systems or land treatment projects.

Fences

The construction of approximately 150 miles of allotment boundary and division fence is planned for the Arkansas watershed on the public domain. This amount of fencing is necessary to adequately control numbers and seasons of use by livestock. The location of this type of project must necessarily be administratively determined for each grazing allotment.

Fire Trails (Truck Trails)

Construction of an estimated 300 miles of trails will be necessary to provide adequate access to the public range for range improvement conservation, fire suppression, and to fulfill an increased demand for hunting and recreation access.

Other Improvements

Other improvements needed and planned include additional range use facilitating and erosion control type projects. They include bridges and cattleguards on truck trails; pitting by machine for water conservation and vegetal improvement on rangeland; control of weeds, pests, and predators; range seeding; plots for study of range condition and trend; and tree planting for erosion control after fires. All of these structures and practices are designed to restore, maintain or improve the surface resources of the public land in the area.

Table 10--Range Conservation and Improvement Needs in Area 1, Arkansas-White-Red River Basins, Colorado, 1961

Conservation Practices and Structures	Unit	Number Units	Cost				Cost Distribution	
			Per Unit	Total for Units	Maintenance	Grand Total	BLM	Contribution
Surveys	acres	100,000	\$.05	\$ 5,000	-	\$ 5,000	\$ 5,000	-
Brush Control (Pinon)	acres	41,000	6.00	246,000	-	246,000	150,000	\$ 96,000
Checks	number	1,800	470.00	846,000	\$ 70,500	916,500	916,500	-
Fencing	miles	150	800.00	120,000	15,000	135,000	80,000	55,000
Pest Control	acres	55,000	.08	4,400	-	4,400	4,070	330
Reseeding	acres	40,500	3.45	139,725	-	139,725	83,000	56,725
Weed Control (chemical)	acres	4,500	5.15	23,175	-	23,175	16,175	7,000
Gully Control	miles	400	75.00	30,000	7,500	37,500	37,500	-
Detentions	number cu. yds.	10 150,000	.80	120,000	30,000	150,000	150,000	-
Dikes	lin. ft. cu. yds.	13,000 52,000	.28	14,560	3,660	18,220	16,854	1,366
Diversions	number cu. yds.	100 100,000	.28	28,000	7,000	35,000	32,375	2,625
Reservoirs	number cu. yds.	450 900,000	.28	252,000	63,000	315,000	189,000	126,000
Springs	number	130	600.00	78,000	15,000	93,000	49,000	44,000
Wells	number	15	5,200.00	78,000	5,000	83,000	50,000	33,000
Study Plots	number	20	500.00	10,000	1,000	11,000	8,000	3,000
Truck Trails	miles	300	700.00	210,000	52,000	262,000	210,000	52,000
Contouring	acres	1,500	2.50	3,750	-	3,750	3,000	750
TOTALS			TOTALS	\$2,208,610	\$269,660	\$2,478,270	\$2,000,474	\$477,796
Estimated Cost Distribution by Activities								
Soil and Moisture								
Range Improvement								
Weed Control								
Contributed								
TOTAL								

Range Use Adjustments

Need for adjustments in grazing practices on much of the range open to livestock use was evident during the 1953 inventory. This survey showed most of Area 1 to be in one of the lower condition classes. Adjustment measures advisable were shown to be adjustment in intensity of stocking, distribution, and seasonal use. This study showed that concentration of excess numbers on vulnerable sites should be eliminated by adjustments in numbers, more intense supervision, and by installing management aids such as fences, watering places, and supplemental forage. This study also revealed that seasonal use should be regulated to coincide with proper plant development and the readiness of the soil to withstand trampling by stock. The adjustment needed in stocking varied from minor reductions on range that was only slightly overstocked to the elimination of use on critical erosion and flood producing areas. Areas then grazed included sites with very steep slopes, shallow or poor soils, and slopes on which misuse had destroyed much of the vegetation. On such sites, adjustments in use were made in order to arrest resource deterioration and to restore the watershed to near its optimum condition. Use on the deteriorated areas was curtailed until such time as the rehabilitation of the vegetation and the stabilization of the soil will allow increased grazing use.

Cadastral Surveys

Consolidation of the public land, whether by exchange or other means, makes it necessary to locate accurately the land involved. Cadastral surveys in Area 1 were begun in the early 1800's and are still continuing. The monuments of the early surveys have become obliterated or they do not describe corners with accuracy and detail found necessary for modern engineering needs. Thus the cadastral survey program requires resurveys as well as original surveys. The cadastral program for the past many years has suffered from lack of funds to maintain the old surveys and keep them up to modern engineering requirements or to keep the physical evidence of the older surveys from disappearing. New surveys or resurveys of 15 townships are necessary in Area 1 to facilitate the exchanges, the disposal or the management of the resources of the public domain. This survey work would be performed by the Cadastral Engineering Branch of the Bureau of Land Management.

APPENDIX A

Principal plants growing on rangelands and timberlands of Area 1, Arkansas-White-Red River Basins. Area 1 is the upper reaches of the Arkansas River in the Rocky Mountains of Colorado. Symbols listed include those of the three principal species of plants in range type areas as shown on the Huerfano Area Vegetation Type Map with this report. Compiled from "Standardized Plant Names," H. P. Kelsey and W. A. Dayton; J. H. McFarland Co., Harrisburg, Pa., 1942.

<u>Symbol</u>	<u>Scientific Name</u>		<u>Common Name</u>
		<u>Grasses</u>	
Acr	Agropyron	cristatum	Crested Wheatgrass
Asm	Agropyron	smithi	Bluestem Wheatgrass
Asp	Agropyron	spicatum	Bearded Bluebunch Wheatgrass
Aal	Agrostis	alba	Redtop Bentgrass
ARI	Aristida	spp.	Threeawn
Alo	Aristida	longiseta	Red Threeawn
Btr	Blepharoneuron	tricholepis	Pine Dropseed
Bcu	Bouteloua	curtipendula	Sideoats Grama
Bgr	Bouteloua	gracilis	Blue Grama
Bca	Bromus	carinatus	Mountain Brome
Bin	Bromus	inermis	Smooth Brome
Bte	Bromus	tectorum	Cheatgrass Brome
Cru	Calamagrostis	rubescens	Pinegrass
Clo	Calamovilfa	longifolia	Prairie Sandreed
Dpa	Danthonia	parryi	Parry Danthonia
Dca	Deschampsia	caespitosa	Tufted Hairgrass
Dst	Distichlis	stricta	Inland Saltgrass
Eam	Elymus	ambiguus	Colorado Wildrye
Eca	Elymus	canadensis	Canada Wildrye
Eco	Elymus	condensatus	Giant Wildrye
FES	Festuca	spp	Fescue
Fid	Festuca	idahoensis	Idaho Fescue
Foc	Festuca	octoflora	Sixweeks Fescue
Fov	Festuca	ovina	Sheep Fescue
Fth	Festuca	thurberi	Thurber Fescue

<u>Symbol</u>	<u>Scientific Name</u>		<u>Common Name</u>
	<u>Grasses, cont'd.</u>		
Hki	Hesperochloa	kingi	Spikefescue
Hja	Hilaria	jamesi	Galleta
Hju	Hordeum	jubatum	Foxtail Barley
Kcr	Koeleria	cristata	Prairie Junegrass
MUH	Muhly		Muhly
Mmo	Muhlenbergia	montana	Mountain Muhly
Msq	Munroa	squarrosa	False Buffalograss
Ohy	Oryzopsis	hymenoides	Indian Ricegrass
Pal	Phleum	alpinum	Alpine Timothy
Ppe	Phleum	pratense	Timothy
POA	Poa	spp	Bluegrass
Pfe	Poa	fendleriana	Mutton Bluegrass
Ppr	Poa	pratensis	Kentucky Bluegrass
Pse	Poa	secunda	Sandberg Bluegrass
Spa	Schedonnardus	paniculatus	Tumblegrass
Shy	Sitanion	hystrix	Bottlebrush Squirreldtail
Sai	Sporobolus	airoides	Alkali Sacaton
Sco	Stipa	comata	Needleandthread
Spi	Stipa	pinetorum	Pinewoods Needlegrass
Svi	Stipa	viridula	Green Needlegrass
Tsp	Trisetum	spicatum	Spike Trisetum
	<u>Grasslike Plants</u>		
CAR	Carex	spp.	Sedges
Cel	Carex	eleocharis	Needleleaf Sedge
Cfi	Carex	filifolia	Threadleaf Sedge
Cge	Carex	geyeri	Elk Sedge
JUN	Juncus	spp.	Rush
	<u>Forbs and Weeds</u>		
Ala	Achillea	lanulosa	Western Yarrow
ACT	Actinea	spp.	Actinea
Ata	Agoseris	taraxacifolia	Dandelion Agoseris
ALL	Allium	spp.	Onion
AMA	Amaranthus	spp.	Amaranth
Alu	Anemone	ludoviciana	American Pasqueflower
Aam	Angelica	ampla	False Waterhemlock
ANT	Antennaria	spp.	Pussytoes

<u>Symbol</u>	<u>Scientific Name</u>		<u>Common Name</u>
	<u>Forbs and Weeds, cont'd.</u>		
Aac	Aplopappus	acaulis	Stemless Goldenweed
Acq	Aquilegia	coerulea	Colorado Columbine
ARG	Argemone	spp.	Pricklepoppy
ASR	Aster	spp.	Aster
AST	Astragalus	spp.	Milkvetch
Bsa	Balsamorhiza	sagittata	Arrowleaf Balsamroot
BID	Bidens	spp.	Beggarticks
Cnt	Calochortus	nuttalli	Segolily Mariposa
Cco	Castilleja	coccinea	Indian Paintbrush
Cal	Chenopodium	album	Lambsquarters Goose-foot
CIR	Cirsium	spp.	Thistle
Cse	Cleome	serrulata	Bee Spiderflower
CRU	Cruciferae	family	Mustard; Crucifer
Ean	Epilobium	angustifolium	Fireweed
EQU	Equisetum	spp.	Horsetail
ERI	Erigeron	spp.	Fleabane
ERO	Eriogonum	spp.	Eriogonum
Gvi	Geranium	viscossissimum	Sticky Geranium
GIL	Gilia	spp.	Gilia
Gle	Glycyrrhiza	lepidota	American Licorice
Gsq	Grindelia	squarrosa	Curlycup Gumweed
HEN	Helenium	spp.	Sneezeweed
Han	Helianthus	annuus	Common Sunflower
Hla	Heracleum	lanatum	Common Cowparsnip
HIE	Hieracium	spp.	Hawkweed
IRI	Iris	spp.	Iris
LAC	Lactuca	spp.	Lettuce
LAT	Lathyrus	spp.	Peavine
LUP	Lupinus	spp.	Lupine
OEN	Oenothera	spp.	Eveningprimrose; Sundrops
OSM	Osmorhiza	spp.	Sweetroot

<u>Symbol</u>	<u>Scientific Name</u>		<u>Common Name</u>
	<u>Forbs and Weeds, cont'd.</u>		
PEN	Penstemon	spp.	Penstemon
PHL	Phlox	spp.	Phlox
PLA	Plantago	spp.	Plantain
Ppu	Polemonium	pulcherrimum	Skunkleaf Polemonium
Pbi	Polygonum	bistortoides	Knotweed
RAN	Ranunculus	spp.	Buttercup
Ska	Salsola	kali tenuifolia	Tumbling Russianthistle
SEN	Senecio	spp.	Groundsel
SOL	Solidago	spp.	Goldenrod
Tof	Taraxacum	officinale	Common Dandelion
Tpr	Tragopogon	pratensis	Meadow Salsify
TRI	Trifolium	spp.	Clover
VER	Veratrum	spp.	Falsehellebore
VES	Verbascum	spp.	Mullein
VIC	Vicia	spp.	Vetch
WYE	Wyethia	spp.	Wyethia

Trees and Shrubs

ACE	Acer	spp.	Maple
Aal	Amelanchier	alnifolia	Serviceberry
AMO	Amorpha	spp.	Leadplant
ARC	Arctostaphylos	spp.	Manzanita
Auv	Arctostaphylos	uva-ursi	Bearberry; Kinnikinnick
Aca	Artemisia	cana	Silver Sagebrush
Afr	Artemisia	frigida	Fringed Sagebrush
Ano	Artemisia	nova	Black Sagebrush
Ask	Artemisia	spinescens	Bud Sagebrush
Atr	Artemisia	tridentata	Big Sagebrush
Acx	Atriplex	canescens	Fourwing Saltbush
Aco	Atriplex	confertifolia	Shadscale Saltbush
Aga	Atriplex	gardneri	Gardner Saltbush
Cin	Cercocarpus	intricatus	Littleleaf Mountain-mahogany
Cle	Cercocarpus	ledifolius	Curleaf Mountain-mahogany

<u>Symbol</u>	<u>Scientific Name</u>		<u>Common Name</u>
	<u>Trees and Shrubs, cont'd.</u>		
CMO	Cercocarpus	montanus	True Mountainmahogany
CHY	Chrysothamnus	spp.	Rabbitbrush
Cst	Cornus	stolonifera	Redosier Dogwood
EPH	Ephedra	spp.	Mormon tea
Ela	Eurotia	lanata	Common Winterfat
Gsp	Grayia	spinosa	Spiny Hopsage
Gsa	Gutierrezia	sarothrae	Broom Snakeweed
Hdu	Holodiscus	dumosus	Bush Rockspirea
JUP	Juniperus	spp.	Juniper
Maq	Mahonia	aquifolium	Oregongrape
Opo	Opuntia	polyacantha	Plains Pricklypear
Pra	Peraphyllum	ramosissimum	Squawapple
PHY	Physocarpus	spp.	Ninebark
Pen	Picea	engelmanni	Engelmann Spruce
Ppu	Picea	pungens	Colorado Spruce
Pcx	Pinus	contorta latifolia	Lodgepole Pine
Ped	Pinus	edulis	Pinon Pine
Pfl	Pinus	flexilis	Limber Pine
Ppo	Pinus	ponderosa	Western Yellow Pine; Ponderosa Pine
Pan	Populus	angustifolia	Narrowleaf Cottonwood
Pde	Populus	deltoides	Eastern Poplar; River Cottonwood
POP	Populus	spp.	Cottonwood
A	Populus	tremuloides	Quaking Aspen
Pfr	Potentilla	fruticosa	Bush Cinquefoil
Pvi	Prunus	virginiana	Black Chokecherry
		melanocarpa	
Pto	Pseudotsuga	taxifolia (menziesi)	Common Douglasfir
Ptr	Purshia	tridentata	Antelope Bitterbrush
QUE	Quercus	spp.	Oak
Rtr	Rhus	trilobata	Skunkbush Sumac
RIB	Ribes	spp.	Currant; Gooseberry
Rfe	Rosa	woodsii fendleri	Fendler Woods Rose

<u>Symbol</u>	<u>Scientific Name</u>		<u>Common Name</u>
<u>Trees and Shrubs, cont'd.</u>			
SLX	Salix	spp.	Willow
SAM	Sambucus	spp.	Elder; Elderberry
Sve	Sarcobatus	vermiculatus	Black Greasewood
SYM	Symphoricarpos	spp.	Snowberry

Ygl	Yucca	glauca	Small Soapweed
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Poisonous Plants

Acm	Aconitum	columbianum	Columbia Monkshood
Ari	Actinea	richardsoni	Pingue Actinea
AST	Astragalus	spp.	Loco; Poisonvetch
CIC	Cicuta	spp.	Waterhemlock
Cmc	Conium	maculatum	Poisonhemlock
DEL	Delphinium	spp.	Larkspur
Hho	Helenium	hoopesi	Orange Sneezeweed
OXY	Oxytropis	spp.	Crazyweed
STA	Stanleya	spp.	Prince's Plume
Tdi	Toxicodendron	diversilobum	Pacific Poisonoak
Tra	Toxicodendron	radicans rydbergi	Western Poisonivy
TRI	Triglochin	spp.	Podgrass
XAN	Xanthium	spp.	Cocklebur
	(poisonous in the cotyledonous stage only)		
ZYG	Zigadenus	spp.	Deathcamas

APPENDIX B

Range type designations. Shown in color on the three Vegetative Type Maps with this report. Huerfano Area Vegetation Type Map shows the range type number preceding the symbols for the three principal plants. Last number on this line, 2.0 to 102.0, gives the number of surface acres necessary to adequately provide sufficient forage for one animal unit for one month.

Type No. Type name	Plants in the Type and Type Characteristics	Remarks
1- Grass	Gramma, wheatgrass, bluestem, buffalo grass, junegrass; bunch grass; any grass; dry sedges; Alpine grassland.	Grassland; Prairie, hills, mountains, plateaus. Pure or mixed stands of perennial grasses and/or sedges.
2- Meadow	Meadow sedges, moisture enduring grasses and sedges with high density and high production.	Wet or dry meadows; good moisture supply.
3- Weeds	Perennial weeds; untimbered areas.	Type usually soon replaced.
4- Sagebrush Untimbered	Big sagebrush, silver sagebrush, sand sagebrush, bud sagebrush. Type frequently may be largely composed of grass.	Shrubby species of sagebrush dominant in aspect. With or without grass or other plants.
5- Browse-Shrub Untimbered	Browse and shrubs, except sagebrush, predominate	Mountain mahogany, willows, Ceanothus
6- Conifer Pine, Fir, Spruce	Woodland type, supporting browse, grasses and weeds.	Usually quite open; Ponderosa pine.
7- Waste, Dense timber and brush	No value or slight value for grazing, not barren.	Large areas of very sparse forage.

Type No. Type name	Plants in the Type and Type Characteristics	Remarks
8- Barren,no veg. or very little vegetation.	Lake beds, sand dunes, saline flats, lava flows, rock, talus slopes.	To be differentiated from waste lands.
9- Pinon Juniper	Pinon pine and Juniper, Digger pine;Pinon alone; Juniper alone.	May have an excellent stand of grass and/or other forage, or none.
10-Broad-leaf, De- ciduous trees	Cottonwood, Aspen, Oak birch, Alder, Ash, Elm	Frequently along rivers or drainages. Mountain aspen groves.
13-Saltbush, Atriplex	Atriplex is dominant. Separate from Desert Shrub.	Atriplex is sufficiently dominant to show type.
14-Greasewood- Sarcobatus	Where Sarcobatus is dom- inant. Valley floors.	Overflow areas, with saline soils.
16-Desert Shrub- General Type	Coleogyne, Simmondsia, Acacia, Mimosa, Hopsage.	Hopsage, Horse brush, Rabbit-brush.
17-Half Shrub	Gutierrezia, Aplopappus, Eriogonum, Artemisia frigida.	Seldom of sufficient size to type.
18-Annual Weeds	Annual weeds; cheat grass, six weeks fescue, russian thistle, mustard, many annual weeds in pure or mixed stands.	Indicates severe con- tinued overuse or site disturbance.

Appendix C. - Description and definitions of land-use capability classes ^{1/}

Class	Suitable for	Topography		Characteristic Native Vegetation	Soil Characteristics						Vulnerability to Erosion	Requisite Special Practices
		Slope (percent)	Character of surface		Texture	Depth	Relative Salinity	Fertility	Productivity	Drainage		
I	Best type of farming land	0 to 2	Level or nearly level	Tall and mid-grasses, thrifty sagebrush, deciduous trees	Medium; Friable	12" or more; subsoil 36" or more	Negligible	High	Good to High	Good to Excellent	Low	None to minor
II	Farming with simple conservation practices	0 to 10	Irregular	Tall, mid, and short grasses; big sagebrush, deciduous trees	Light to Heavy; Friable	8" or more; subsoil 36" or more	Negligible to slight	Good to High	Moderate to High	Good	Slight to Moderate	Minor to simple practices
III	Farming with complex conservation practices	0 to 10	Irregular	Tall, mid, and short grasses; big sagebrush, rabbitbrush, greasewood, coniferous, and deciduous trees	Light to Heavy; Friable	6" or more; subsoil 24" or more	Slight to moderate	Fair to Good	Moderate to High with management	Often poor; may be needed	Moderate to High	Complex practices essential
IV	Perennial hay or pasture; limited cultivation	0 to 15	Irregular or stony	All grasses; big sagebrush, rabbitbrush, greasewood, coniferous, and deciduous trees, saltbush, winterfat	Sandy to Clay; porous or tight	6" or more; may have shallow hardpan	Negligible to critical	Poor to Good	Poor for row crops; best for hay and pasture	Not justifiable if needed	Moderate to High or nil	Complex and intensive practices with good management
V	Range or woodland; farming only if irrigation is developed	0 to 5	Smooth to irregular; may be stony or wet	All grasses; big sagebrush, rabbitbrush, greasewood, coniferous, and deciduous trees	Light to Heavy; Friable	Good permeability to 24" depth	Negligible to moderate	Good to High	Moderate to High	Usually not a problem	Low	None to minor or drainage
VI	Range and woodland only	0 to 20 good soils may have more	Irregular to rough or rocky	All grasses; big sagebrush, rabbitbrush, greasewood, coniferous, saltbush, winterfat	Very Light to Heavy	Shallow to moderate; permeability excessive to poor	Negligible to moderate	Fair to Good	Light to Moderate	Not practicable if a problem	Moderate	Proper management with simple restrictions
VII	Range and woodland with severe restrictions	0 to 100	Rough rocky, or eroded	All grasses; big sagebrush, rabbitbrush, greasewood, coniferous, saltbush, winterfat, mountain browse and annuals	Any: tight clay or sand or gravel	Often shallow, poorly developed	Negligible to critical	May be Poor	Poor to Light	Seldom a problem or not practicable	High	Proper management with complex restrictions and intensive practices
VIII	Watershed, wildlife and recreation	Generally steep or swampy	Extremely rough, barren or inaccessible	Often only annuals or scanty perennials; may be conifer timber	Usually poorly developed	Very shallow or nil	May be excessive for plant growth	Usually very low	Usually very low or nil	Often poor; not justifiable if a problem	High (unless a swamp)	Complete Protection

^{1/} Adapted from Soil Conservation Service Standards, U. S. Department of Agriculture. Any one of the factors listed may classify a soil, factors determining classification singly, not necessarily in combination.

Appendix D

Description and definitions of soil erosion condition classes.

These erosion condition classes are shown on the three Erosion Maps with this report:
Colorado Grazing District 5, Huerfano and Leadville

Erosion Class	Description of degree of erosion	Sheet Erosion <u>1/</u>	Wind Erosion <u>1/</u>	Gully Erosion <u>1/</u>
1	None to Slight	0-10 percent of topsoil removed. Little apparent evidence of surface erosion only in localized areas too small to delineate into Class 2. Vegetation often climax type. Generally smooth to gently undulating plains and forested lands; mostly 0-3% slopes.	None to only local evidence of slight soil drift or surface soil removal. 0-10 percent of topsoil removed. Soil usually well protected by sod or plant litter.	No evidence of active gully-ing. All waterways well established.
2	Slight to Moderate	10-25 percent of topsoil removed, little evidence of vegetation breaking up. Slopes generally moderate; characterized by climax type of vegetation with few annual weeds and of usually lower density than vegetation of Class 1 above.	Local evidence of slight to moderate soil drifting and removal and/or accumulation. Most soils, particularly silty or fine sandy textured, under certain conditions of culture and drought with high winds, are vulnerable.	Occasional active gullies which are usually shallow, occurring primarily along main watercourses at intervals of more than 100 feet. In open areas and where slopes permit, little difficulty in traversing the area in a car.
3	Moderate to Severe	25-50 percent of topsoil removed. "Cat steps" and terraces noticeable. Slopes may be moderate to steep. Bare spots are quite common. Undesirable plants are beginning to dominate the vegetation with climax types more often scattered than dominant. Perennial woody plants frequently pedestalled. Subsoil rarely exposed except in localized areas.	Bare spots common and areas generally more consistently subject to damage by soil blowing. Soils often removed to depths of 1 to 4 inches. Drift accumulations and hummocks noticeable. Sod grass deterioration, plant pedestals in evidence. Plant cover is insufficient for soil protection. Subsoil occasionally exposed. Gravelly soils show pavement appearance.	Occasional gullies shallow or deep more than 100 feet apart. Concentration of runoff and drainage channeling usually due to slopes. Main drainages deeply channeled, U-shaped. Tributaries usually V-shaped. Moderate difficulty traversing in car. Have to "head" gully in crossing. Generally extensive shoe-string or rill gullying.
4	Severe to Critical	50-100 percent of topsoil removed. Subsoil may be exposed in many places with varying depths being removed. Bare spots + trampled out areas common. Plant pedestalling + erosion pavement highly evidenced. Loss of surface soil may be complete; active gullying, high mortality of climax species. Annual and perennial invaders may dominate vegetation.	Majority of topsoil may be removed; usually accompanied by destructive accumulations in form of hummocks and dunes particularly along such obstructions as fences and edges of drainageways. Perennial vegetation often scanty and extensively pedestalled.	Frequent, usually shallow, gullies occurring less than 100 feet apart. Main waterways deeply channeled with active gullying, usually U-shaped. Often incised by shoestring gullies and rills, but not generally so numerous or deep as to destroy land completely. Dissection permits rapid drainage. Corduroyed surface makes car travel impossible.
5	Critical to Extreme	Usually all surface soil has been removed. Utility and productivity of land has been largely destroyed by advanced stages of gully erosion which usually continues, making retirement from use mandatory. Barren wastelands are often in this class. Desirable perennials never have occupied the area or have been practically obliterated. Low density annuals usually predominate.	Represents a condition of soil deterioration amounting to essential destruction. Retirement from further use is mandatory. Artificial treatment is often essential to soil stabilization. Constantly shifting dunes are common. Deep fine sandy soils usually predominate in these areas.	Frequent and deep gullies. Generally represents maximum destruction by erosion. Complete, rapid drainage of surface water and soil moisture through intricate gullies. Deeply channeled waterways with edges broken and caved. Active erosion of gully banks, slopes and bottoms.
<u>1/</u> The Erosion Maps utilize three numbers in series to show the degree of erosion in each of the three types of erosion in this order: sheet, wind, gully. An example would be 3 - 2 - 1.				

CAPABILITY COLOR LEGEND

IV	ARABLE LANDS
V	
VI	GRAZING LANDS
VII	
VIII	WASTE OR BAD LANDS

LEGEND

LANDS

PRIVATE	IP
STATE	IS
PUBLIC DOMAIN	IV
NATIONAL FORESTS	NF
POWER OR RECLAMATION	PS

TOPOGRAPHY

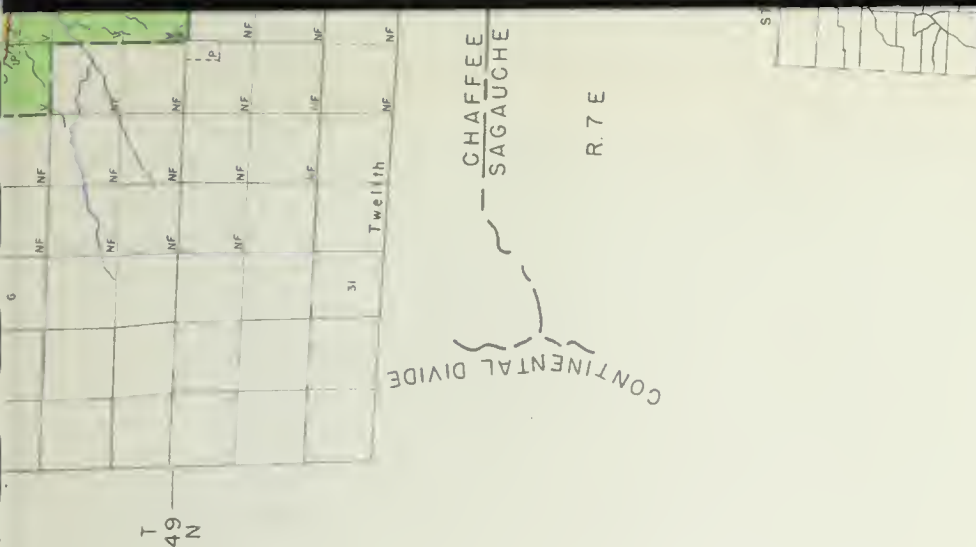
RIVERS	
STREAMS	
LAKES	
RESERVOIRS	
MOUNTAINS	

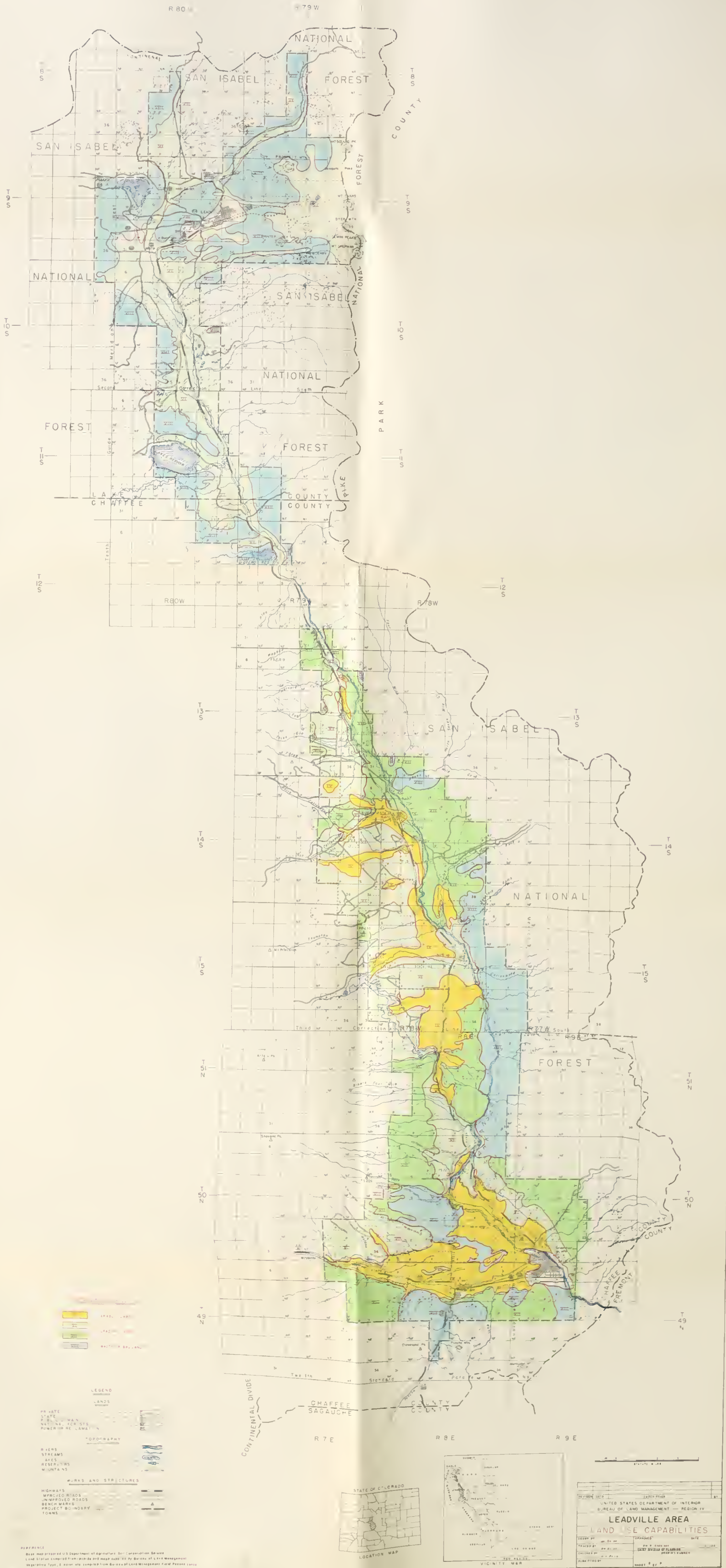
WORKS AND STRUCTURES

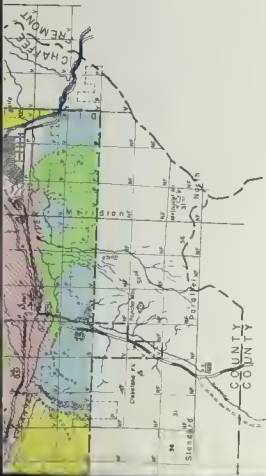
HIGHWAYS	
IMPROVED ROADS	
UNIMPROVED ROADS	
BENCH MARKS	
PROJECT BOUNDARY	
TOWNS	

REFERENCE

Base map prepared U.S. Department of Agriculture Soil Conservation Service
Land Status compiled from records and maps supplied by Bureau of Land Management
Vegetative Type, Erosion etc. compiled from Bureau of Land Management Field Reconnaissance



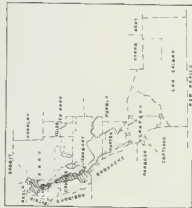




T
—49
N

R 8 E

R 9 E



STATE OF COLORADO

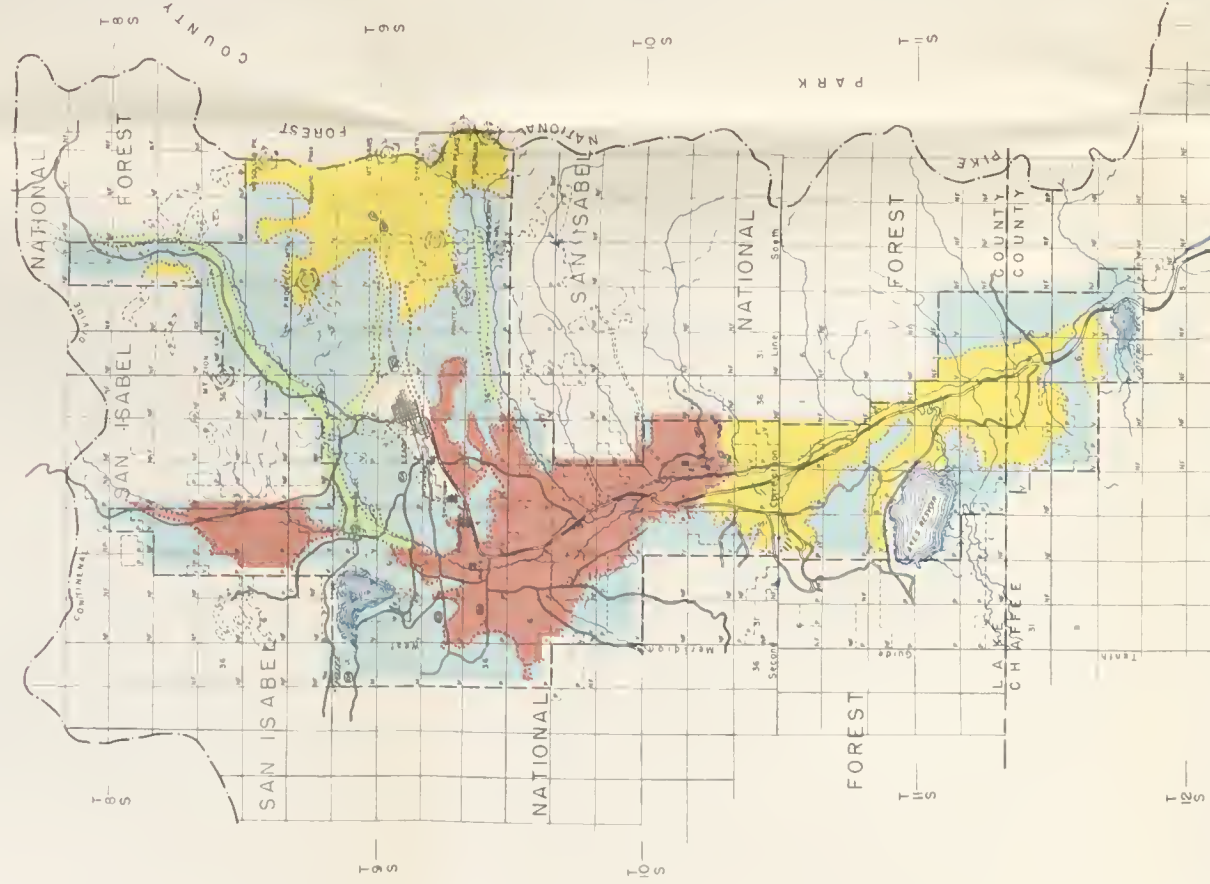


LOCATION MAP



SECTION	TOWNSHIP	RANGE	DESCRIPTION	DATE
31	31	31	UNITED STATES DEPARTMENT OF INTERIOR BUREAU OF LAND MANAGEMENT — REGION IV	
LEADVILLE AREA				
VEGETATIVE TYPE				
VEGETATIVE TYPE				
DATE				
BY				
CHECKED BY				
DATE				
SUBMITTED BY				
PAGE 1 OF 4				

R 80 W R 79 W



T 12 S

T 12 S

R 80 W

R 79 W

T 13 S

T 13 S

T 14 S

T 14 S

T 15 S

T 15 S

T 16 N

T 16 N

T 17 N

T 17 N

T 18 N

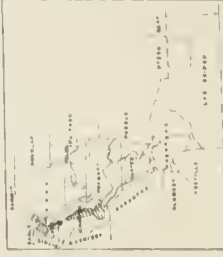
T 18 N



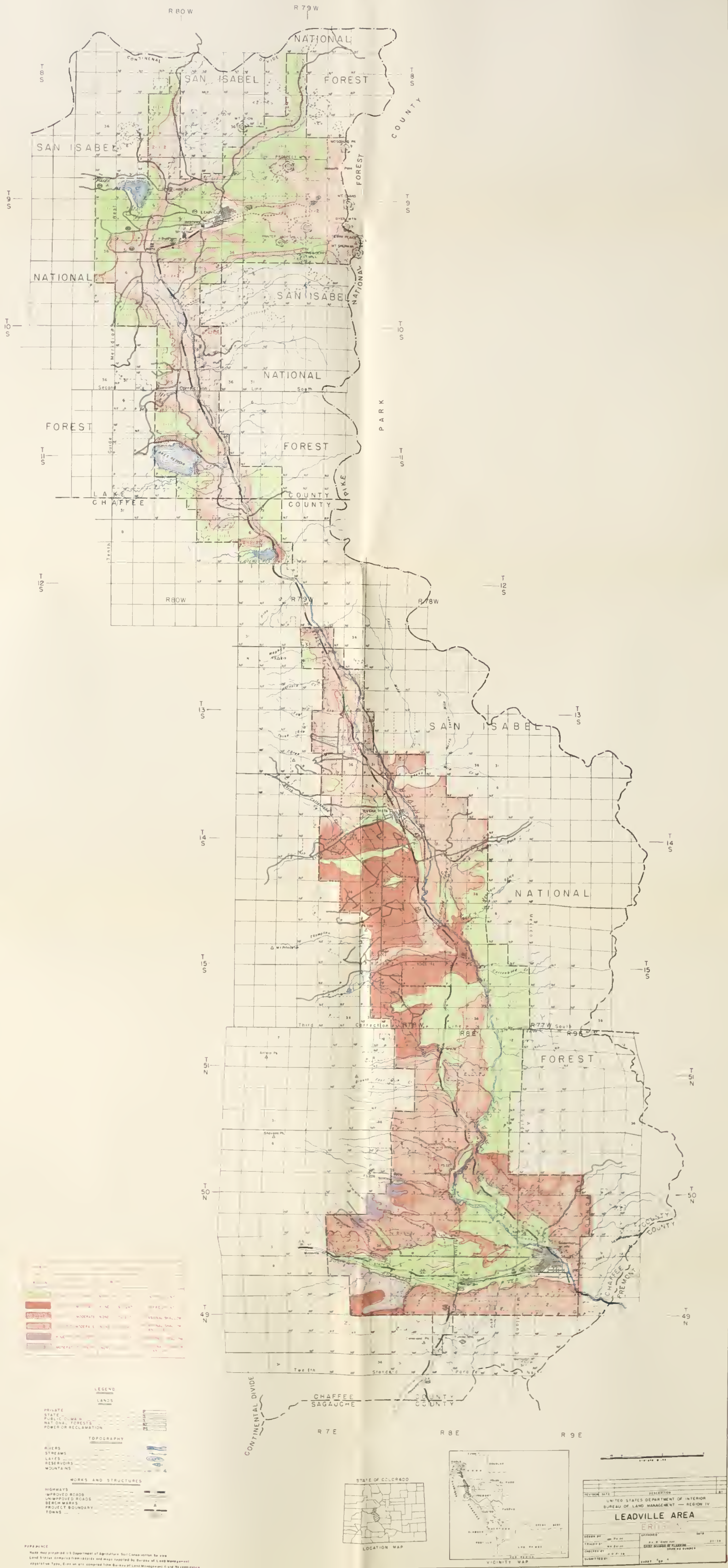
R 7 E

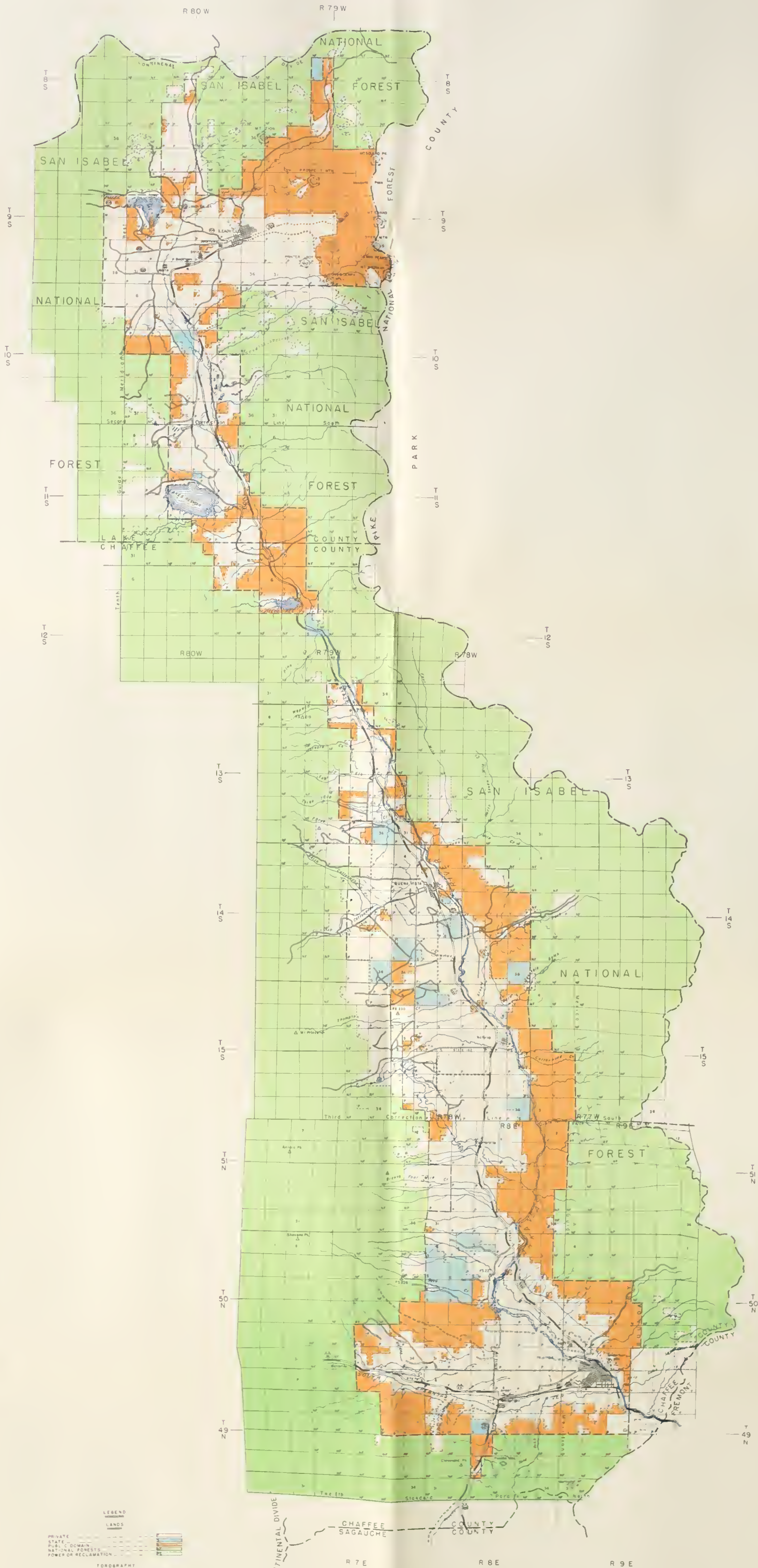
R 8 E

R 9 E



UNITED STATES DEPARTMENT OF INTERIOR BUREAU OF LAND MANAGEMENT REGION IV LEADVILLE AREA VEGETATIVE TYPE
DATE: 1974
BY: [Name]
FOR: [Name]
PROJECT: [Name]
SCALE: 1:50,000
PROJECT NUMBER: [Number]
MAP SHEET: [Number]





LEGEND

LANDS

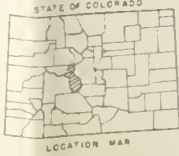
- PRIVATE
- STATE
- PUB. C. DOMAIN
- NATIONAL FORESTS
- POWER OR RECLAMATION

TOPOGRAPHY

- RIVERS
- STREAMS
- LAKES
- RESERVOIRS
- MOUNTAINS

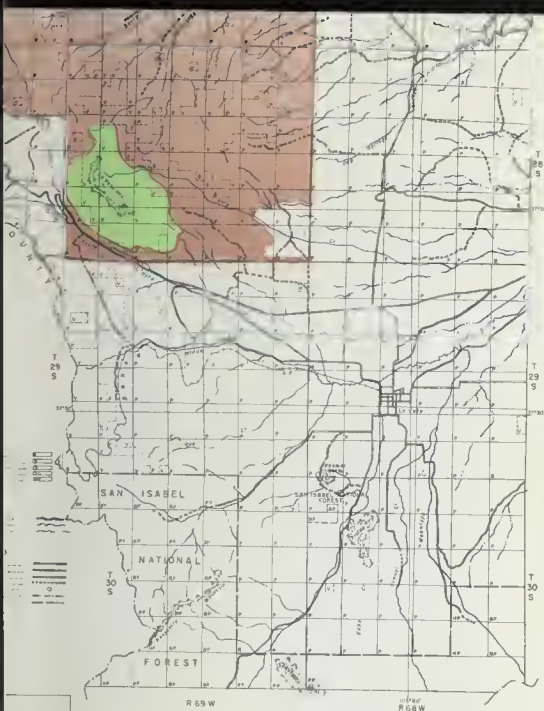
WORKS AND STRUCTURES

- HIGHWAYS
- IMPROVED ROADS
- UNIMPROVED ROADS
- BENCH MARKS
- PROJECT BOUNDARY
- TOWNS

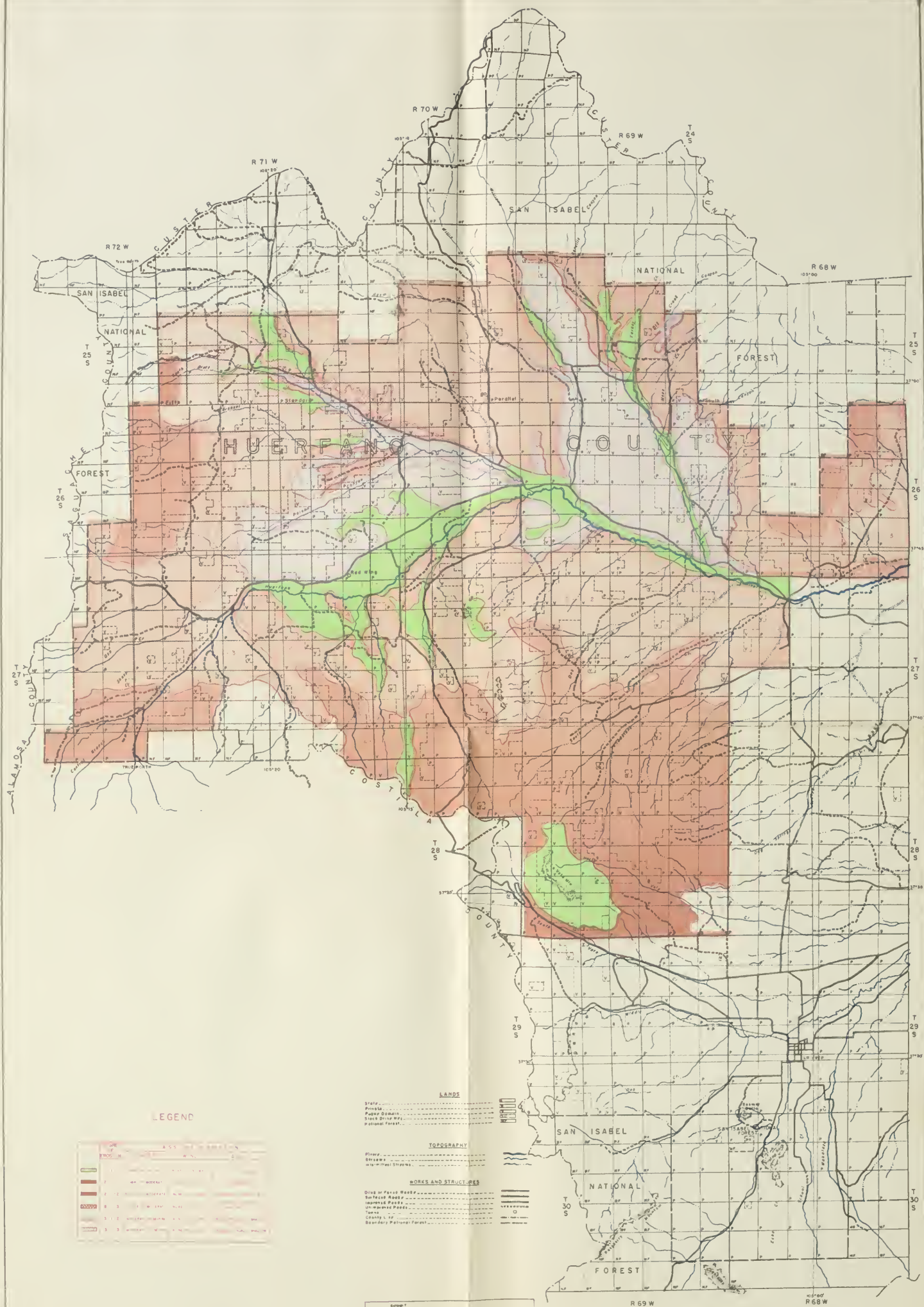


DESCRIPTION	
UNITED STATES DEPARTMENT OF INTERIOR	
BUREAU OF LAND MANAGEMENT - REGION IV	
LEADVILLE AREA	
STAMPED BY	APPROVED BY
TRACED BY	DATE
CHECKED BY	FILE NUMBER
SUBMITTED BY	REVISIONS

REFERENCE: This map prepared by U.S. Department of Agriculture, Soil Conservation Service. Land Status compiled from records and maps supplied by Bureau of Land Management. Vegetative Types, Elevations, etc. compiled from Bureau of Land Management Field Reports.



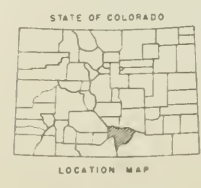
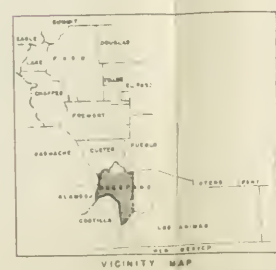
UNITED STATES DEPARTMENT OF INTERIOR BUREAU OF LAND MANAGEMENT - REGION IV	
HUERFANO AREA EROSION	
DESIGNED BY: S. HANLEY, P. H. HANLEY	APPROVED: [Signature]
TRACED BY: A. WATKIN	DATE: 12/1/55
CHIEF OF BUREAU: [Signature]	12/1/55
PERMITTED BY: [Signature]	PAGE NO. 1



LEGEND

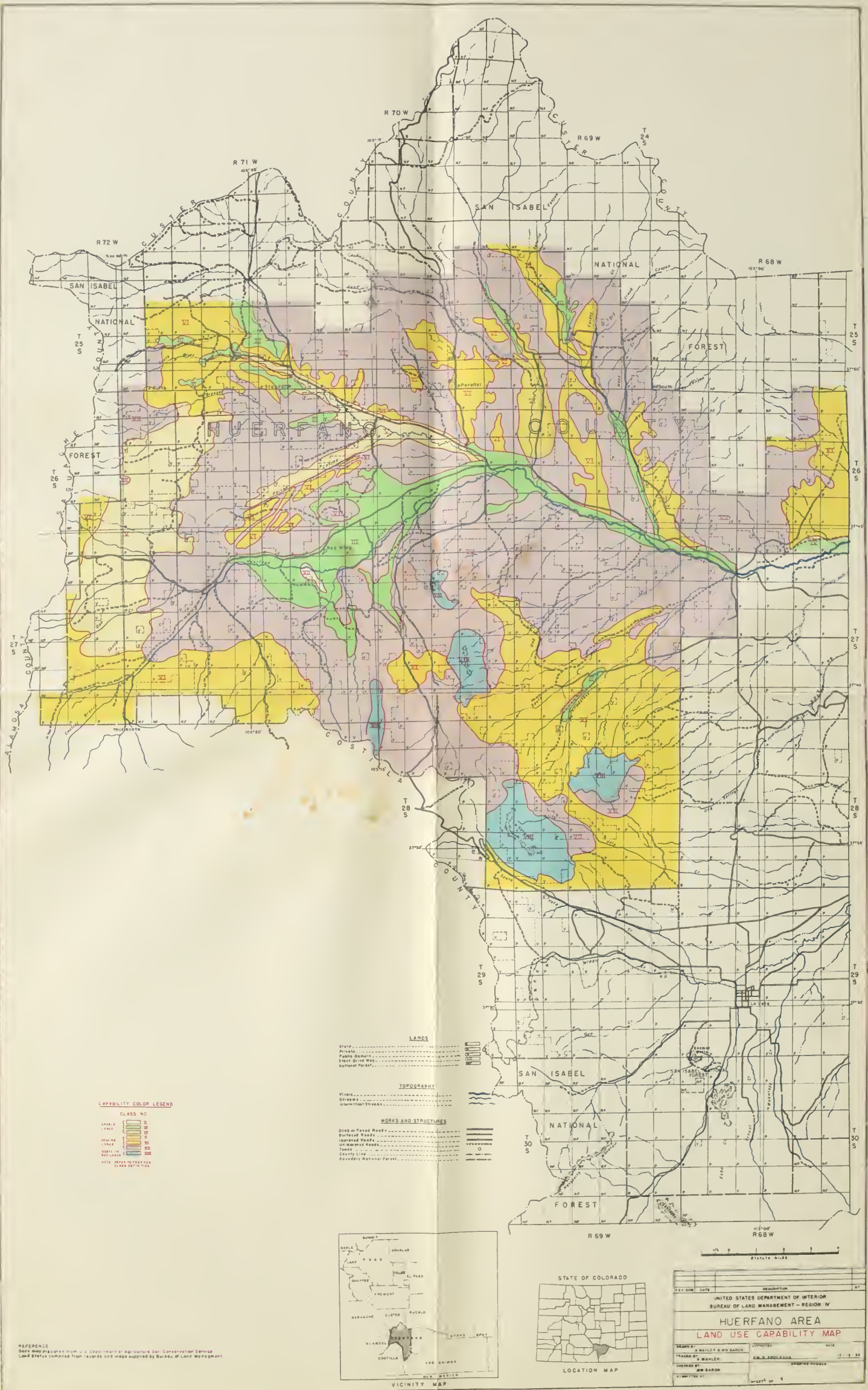
SYMBOL	DESCRIPTION
[Red Box]	1. Erosion - Severe
[Green Box]	2. Erosion - Moderate
[Blue Box]	3. Erosion - Light
[Yellow Box]	4. Erosion - Very Light
[White Box]	5. Erosion - None

LANDS	
State	.....
Private	.....
Public Domain	.....
Stock Grazing	.....
Grassland Forest	.....
TOPOGRAPHY	
Mountains	.....
Streams	.....
Highway	.....
WORKS AND STRUCTURES	
Ditch or Canal	.....
Surface Road	.....
Improved Road	.....
Unimproved Road	.....
Trail	.....
County Line	.....
Boundary	.....



STATE OF COLORADO	
HUERFANO AREA	
EROSION	
DATE	12/1/32
BY	W. H. BARNES
FOR	U. S. DEPARTMENT OF INTERIOR
PROJECT	BUREAU OF LAND MANAGEMENT - REGION IV
SUBMITTED BY	W. H. BARNES
REVIEWED BY	W. H. BARNES
APPROVED BY	W. H. BARNES

REFERENCE: Base map is property from U. S. Department of Agriculture Soil Conservation Service. Land titles compiled from records and maps supplied by Bureau of Land Management.



LAND USE CAPABILITY COLOR LEGEND

CLASS NO.	DESCRIPTION
1	Very High
2	High
3	Medium
4	Low
5	Very Low
6	Barren

NOTE: REFER TO TEXT FOR CLASS DESCRIPTIONS

LANDS

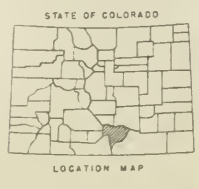
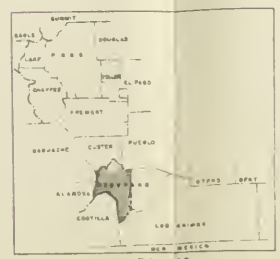
State	-----
Private	-----
Public Domain	-----
State or Fed. Land	-----
National Forest	-----

TOPOGRAPHY

Mountains	-----
Streams	-----
Intermittent Streams	-----

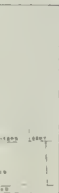
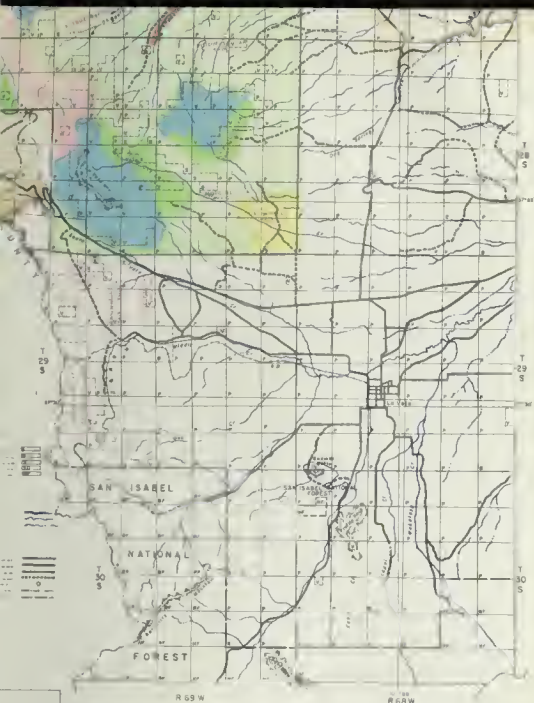
WORKS AND STRUCTURES

Gravel Paved Road	-----
Surface Road	-----
Improved Road	-----
Unimproved Road	-----
Town	-----
County Line	-----
Boundary National Forest	-----



REVISION DATA		DESCRIPTION	
UNITED STATES DEPARTMENT OF INTERIOR		BUREAU OF LAND MANAGEMENT - REGION IV	
HUEFANO AREA		LAND USE CAPABILITY MAP	
PREPARED BY	W. H. BARNES	CHECKED BY	W. H. BARNES
DATE	12-1-52	APPROVED BY	W. H. BARNES
DRAWN BY		DATE	
SCALE		SHEET NO. 4	

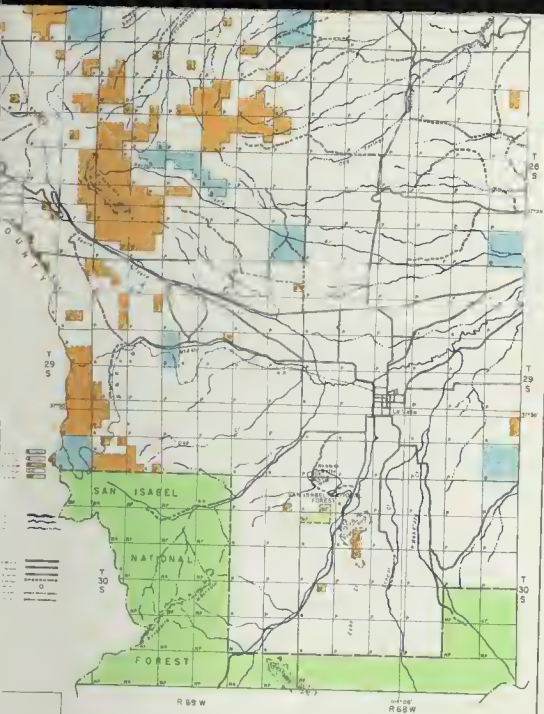
REFERENCE: Data were prepared from U.S. Department of Agriculture Soil Conservation Service Land Use maps compiled from records and maps supplied by Bureau of Land Management.



LOCATION MAP



UNITED STATES DEPARTMENT OF INTERIOR	
BUREAU OF LAND MANAGEMENT - REGION IV	
HUERFANO AREA	
21 2E W	
PROJECT	DATE
TRACED BY	DATE
APPROVED BY	DATE
REVIEWED BY	DATE

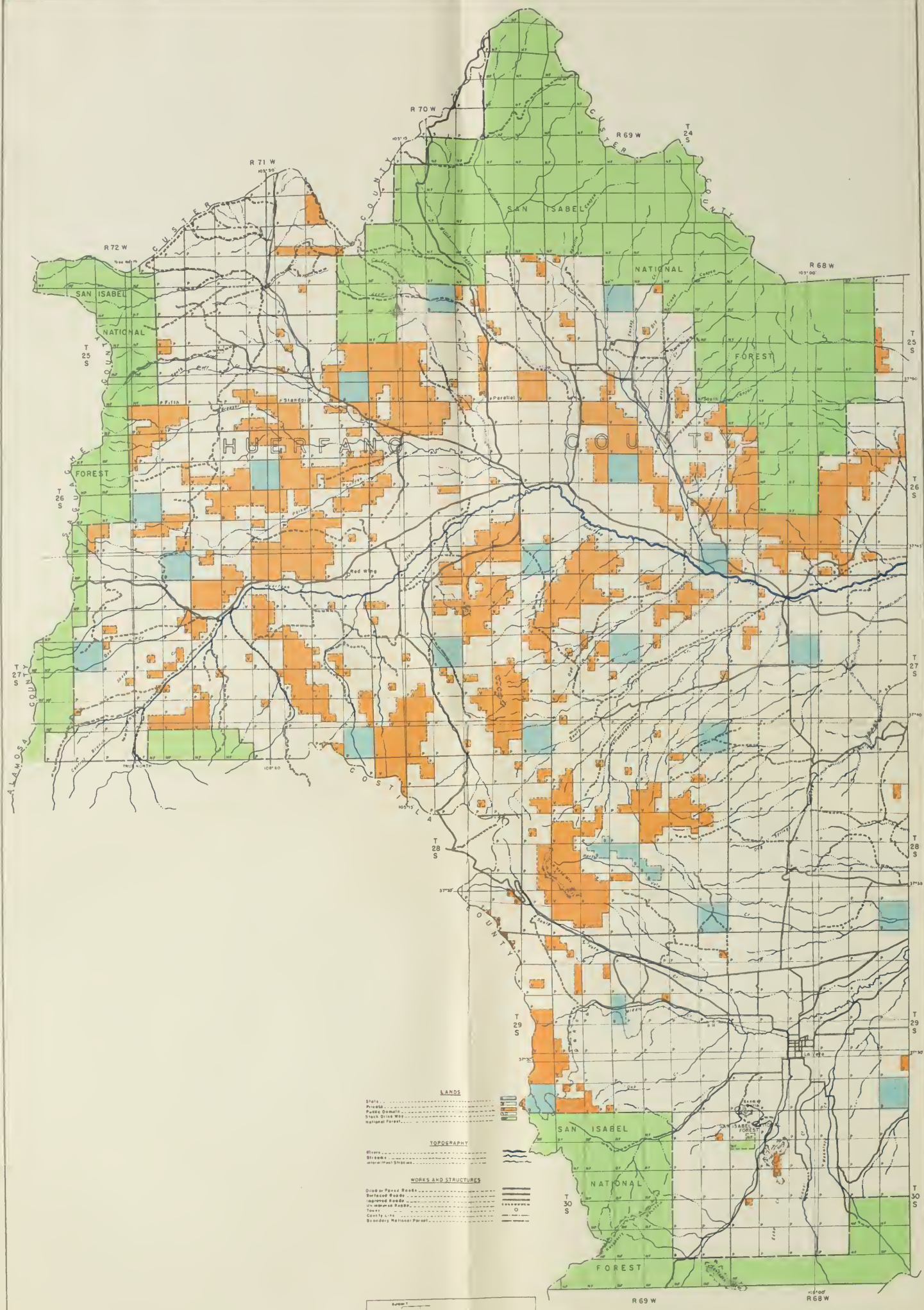


STATE OF COLORADO

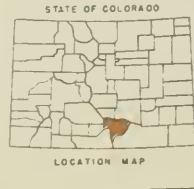


LOCATION MAP

UNITED STATES DEPARTMENT OF INTERIOR BUREAU OF LAND MANAGEMENT - REGION IV	
HUERFANO AREA	
DESIGNED BY W. H. HARRIS	APPROVED BY S. M. HARRIS
DRAWN BY W. H. HARRIS	DATE 12/18/30
CHECKED BY W. H. HARRIS	REVIEWED BY S. M. HARRIS
SHEET 10	

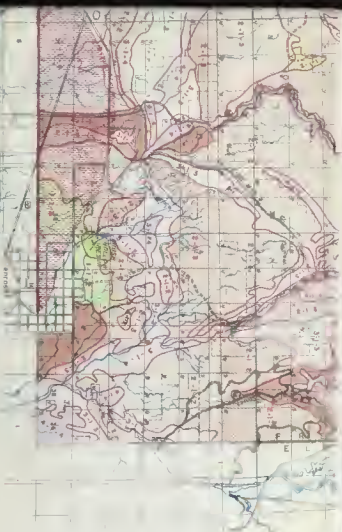


- LANDS**
- State
 - Private
 - Public Domain
 - Track Right of Way
 - National Forest
- TOPOGRAPHY**
- Rivers
 - Creeks
 - Inter or West Slopes
- WORKS AND STRUCTURES**
- Ditch or Power Lines
 - Surface Road
 - Improved Road
 - Unimproved Road
 - Town
 - County Line
 - Boundary Method Parcel



FILE NO.	DATE	DESCRIPTION
UNITED STATES DEPARTMENT OF INTERIOR		
BUREAU OF LAND MANAGEMENT - REGION IV		
HUERFANO AREA		
DRAWN BY	REVIEWED BY	DATE
TRACED BY	FILE NO.	10/18/53
CHECKED BY	FILE NO.	
REVIEWED BY	FILE NO.	

REFERENCE
Base map prepared from U.S. Department of Agriculture Soil Conservation Service
Land Status Composite from various sources and maps supplied by Bureau of Land Management

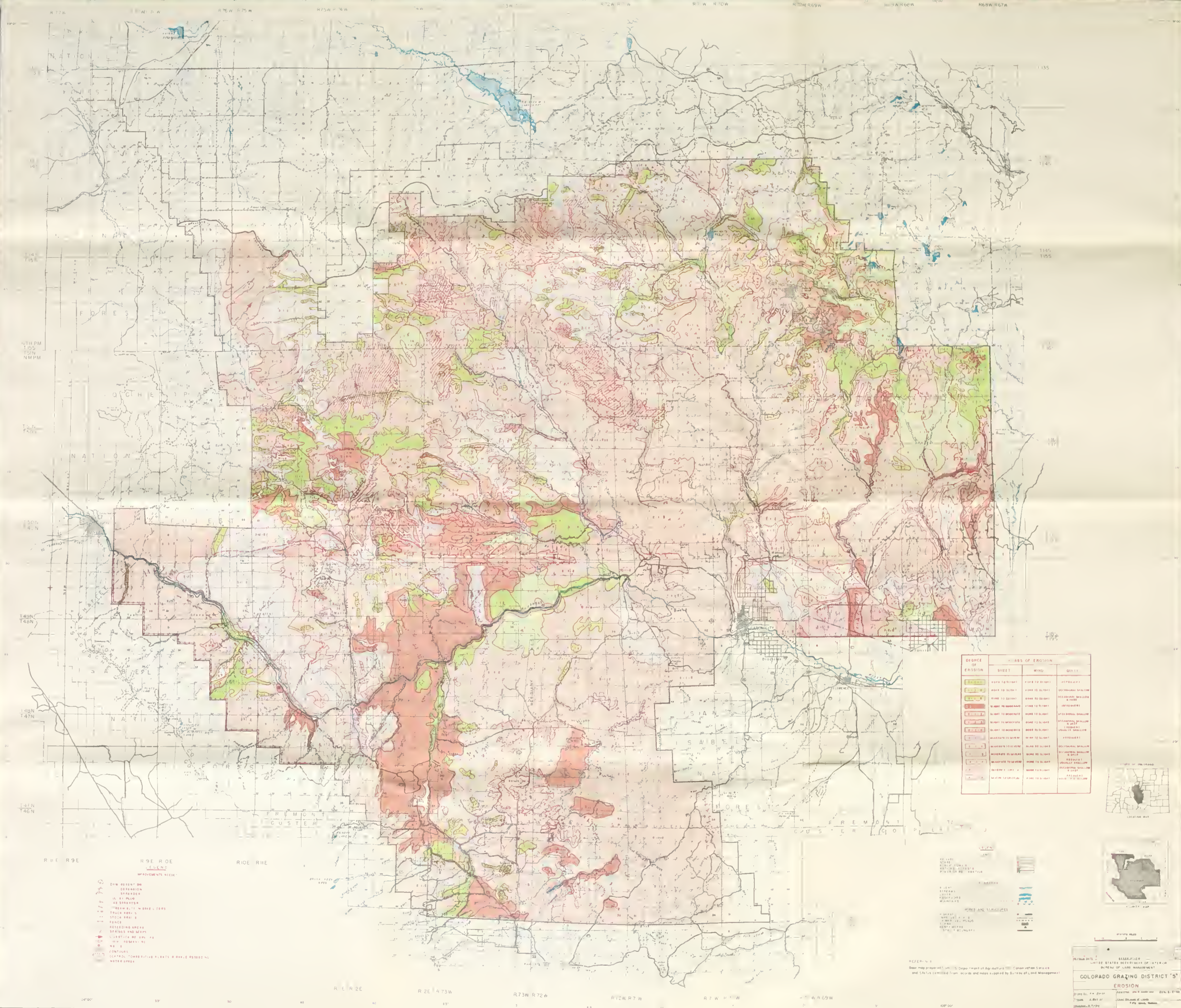


T185
T185

T185
T185

DEGREE OF EROSION	CLASS OF EROSION		
	SHEET	WIND	GULLY

1-2-3-4	none to slight	none to slight	infrequent
5-6-7-8	none to slight	none to slight	occasional shallow
9-10-11-12	none to slight	none to slight	occasional shallow & deep
13-14-15-16	slight to moderate	none to slight	infrequent
17-18-19-20	slight to moderate	none to slight	occasional shallow
21-22-23-24	slight to moderate	none to slight	occasional shallow & deep
25-26-27-28	moderate to severe	none to slight	infrequent
29-30-31-32	moderate to severe	none to slight	occasional shallow
33-34-35-36	moderate to severe	none to slight	occasional shallow & deep

[illegible]

Base map prepared from U.S. Department of Agriculture 1:250,000 General Series 40 and 50, 1:250,000 and 1:500,000 maps, edited by B. A. B. and M. A. B.

[illegible]

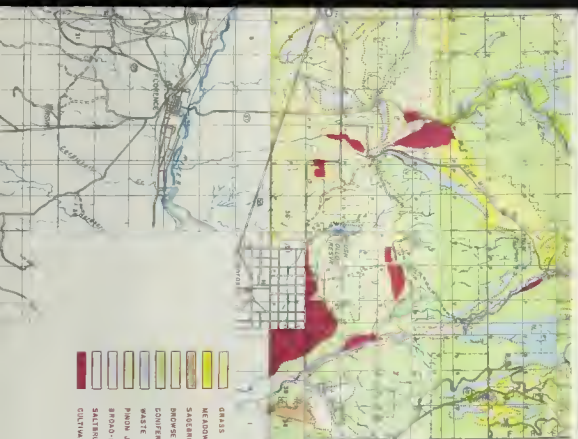
T17S
T18S

50'

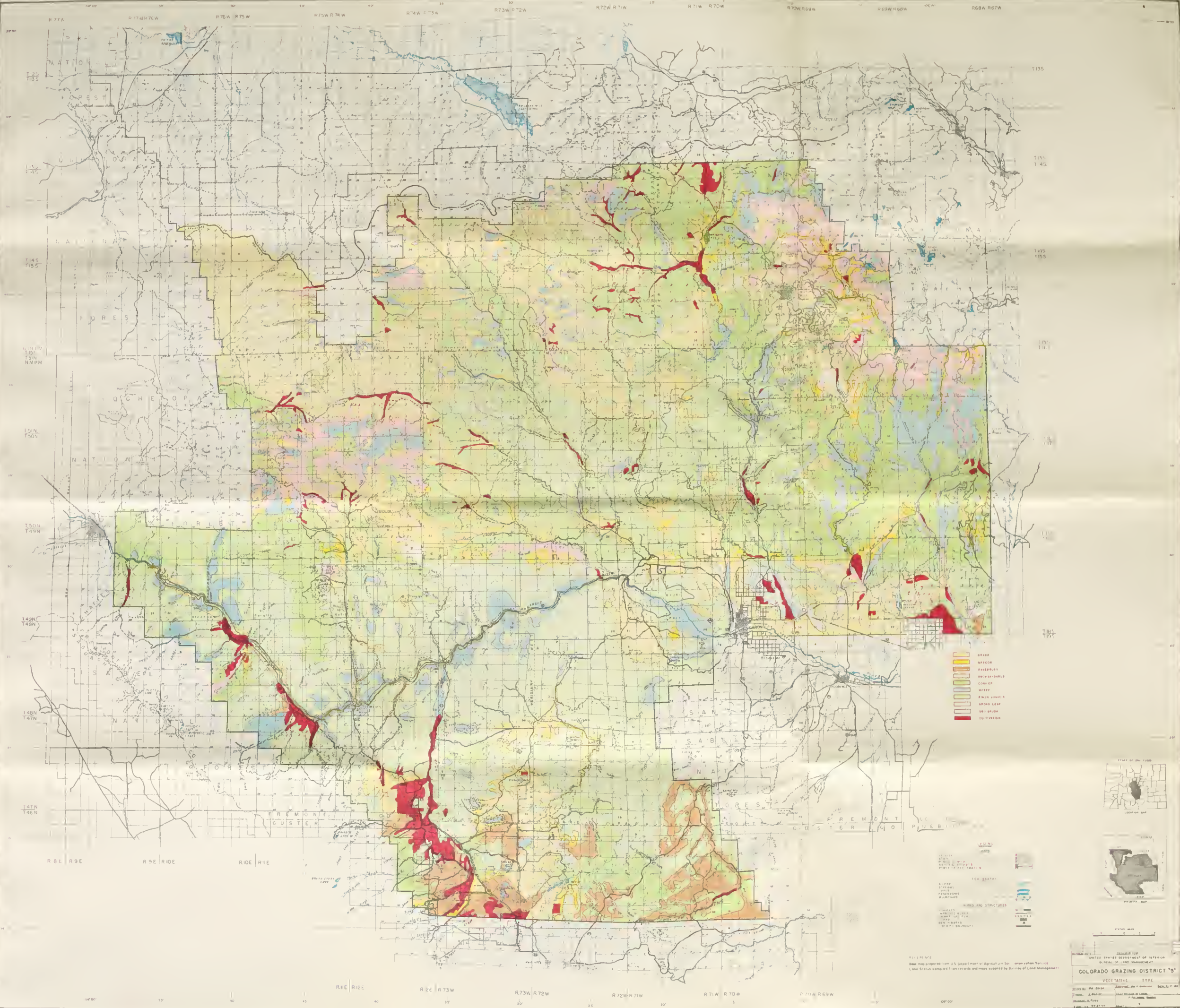
T18S
T19S

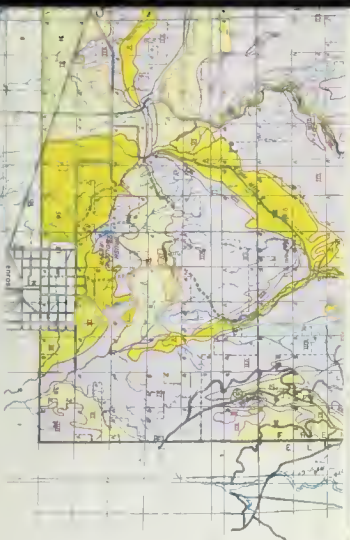
25'

- GRASS
- MEADOW
- SAGEBRUSH
- BROOKER-SHRUB
- CONIFER
- WASTE
- PINON JUNKIE
- BROOD-LEAF
- SALTBRUSH
- CULTIVATION



20'





T18S
T19S

T18S
T19S

STABILITY COLOR LEGEND

CLASS NO.	DESCRIPTION
1	AVAILABLE LANDS
2	GRAZING LANDS
3	WASTE OR BAD LANDS

10'

20'

30'

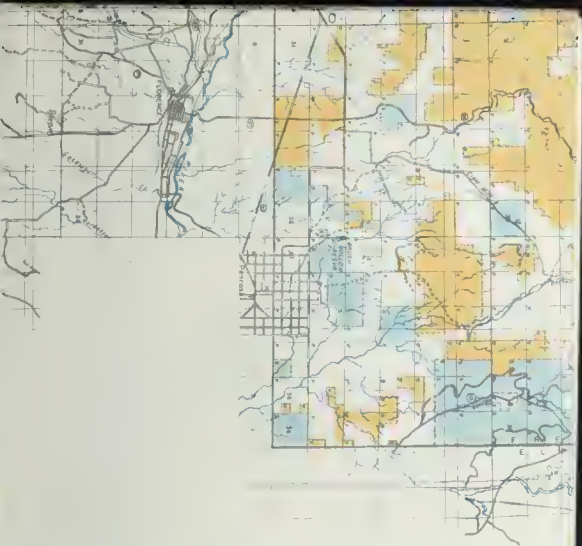
1175
1185

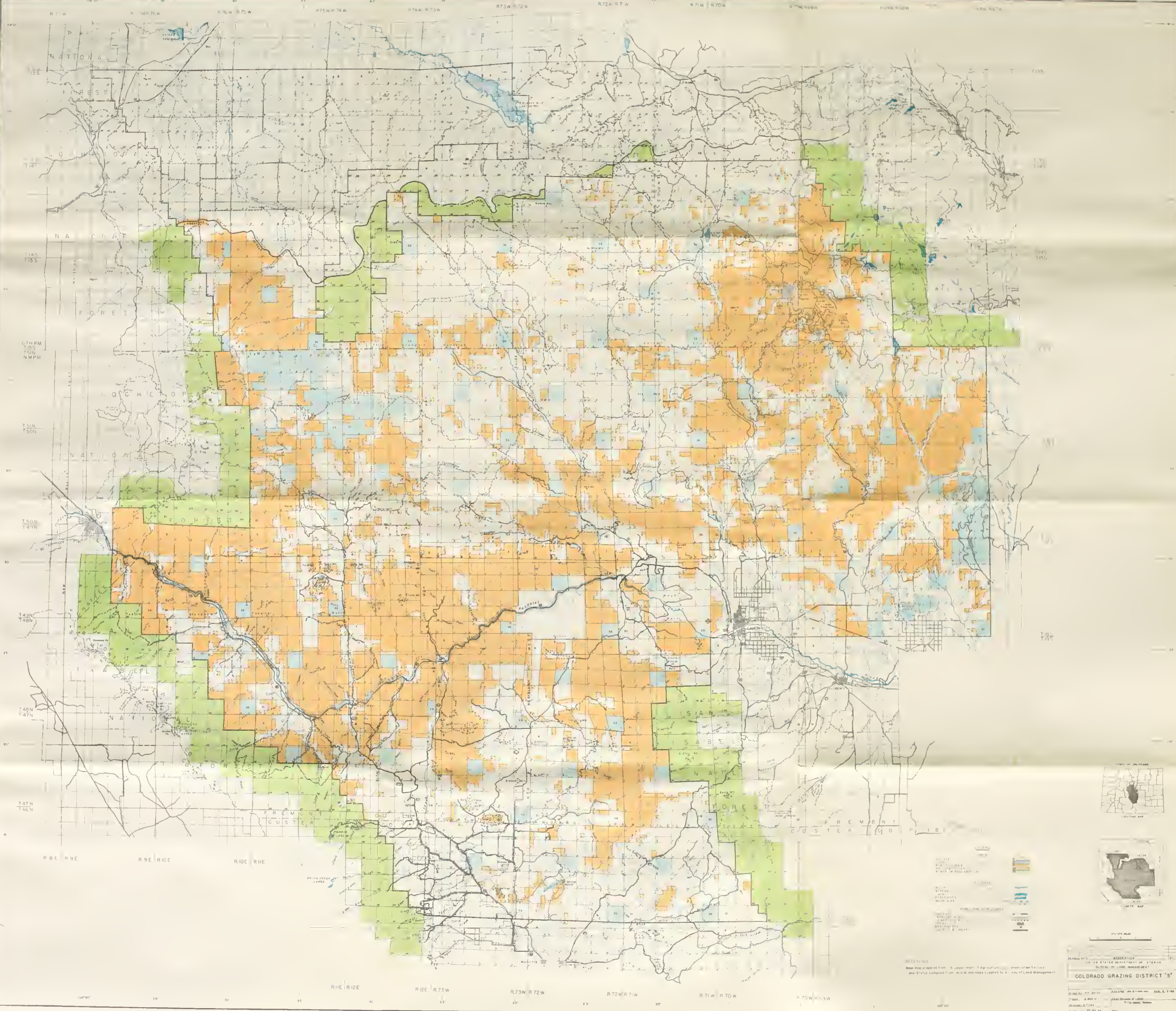
1185
1195

— 30 —

— 25 —

— 20 —





AREA 1 MAPS, UPPER ARKANSAS RIVER BASIN COLORADO

Twelve maps of three separate areas with four maps of each area. The three areas are in the Rocky Mountains of Central Colorado in parts of Chaffee, Custer, El Paso, Fremont, Huerfano, Lake, Park, Pueblo and Teller Counties. Areas mapped are Colorado Grazing District No. 5, Huerfano and Leadville. The four maps of each area are titled Land Status, Land Use Capability, Vegetative Type, and Erosion. Each inventory feature and area is differentiated and depicted in color. The maps are printed on a black sectionized base showing landownership, drainage, and principal cultural features.

Colorado Grazing District 5 Maps

- Erosion
- Land Status
- Land Use Capabilities
- Vegetative Type

Huerfano Area Maps

- Erosion
- Land Status
- Land Use Capability
- Vegetation Type

Leadville Area Maps

- Erosion
- Land Status
- Land Use Capabilities
- Vegetative Type

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